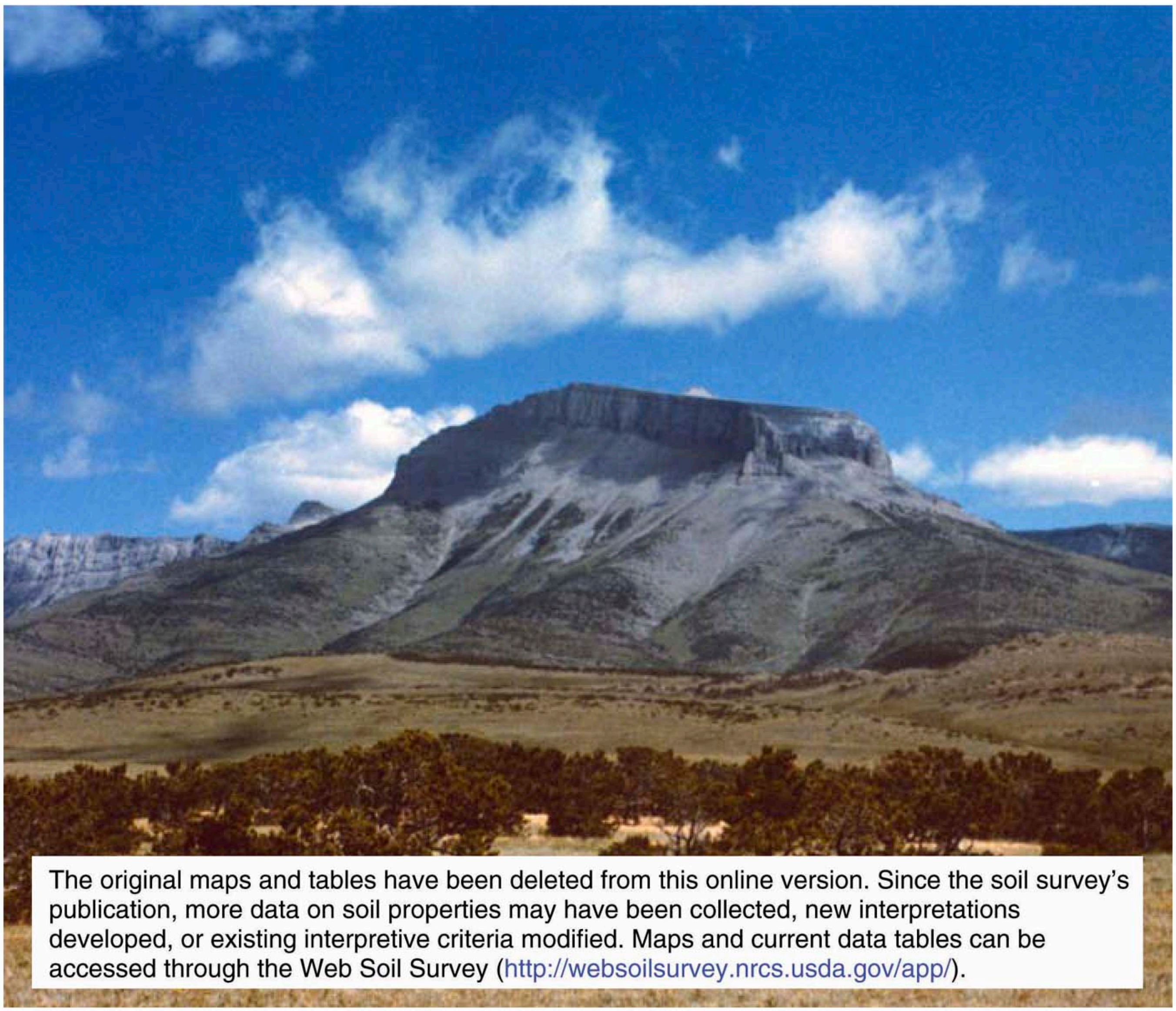
United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with the
Montana Agricultural
Experiment Station

MT657—Soil Survey of Choteau-Conrad Area; Parts of Teton and Pondera Counties, Montana

Part I



The original maps and tables have been deleted from this online version. Since the soil survey's publication, more data on soil properties may have been collected, new interpretations developed, or existing interpretive criteria modified. Maps and current data tables can be accessed through the Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/).

How to Use This Soil Survey

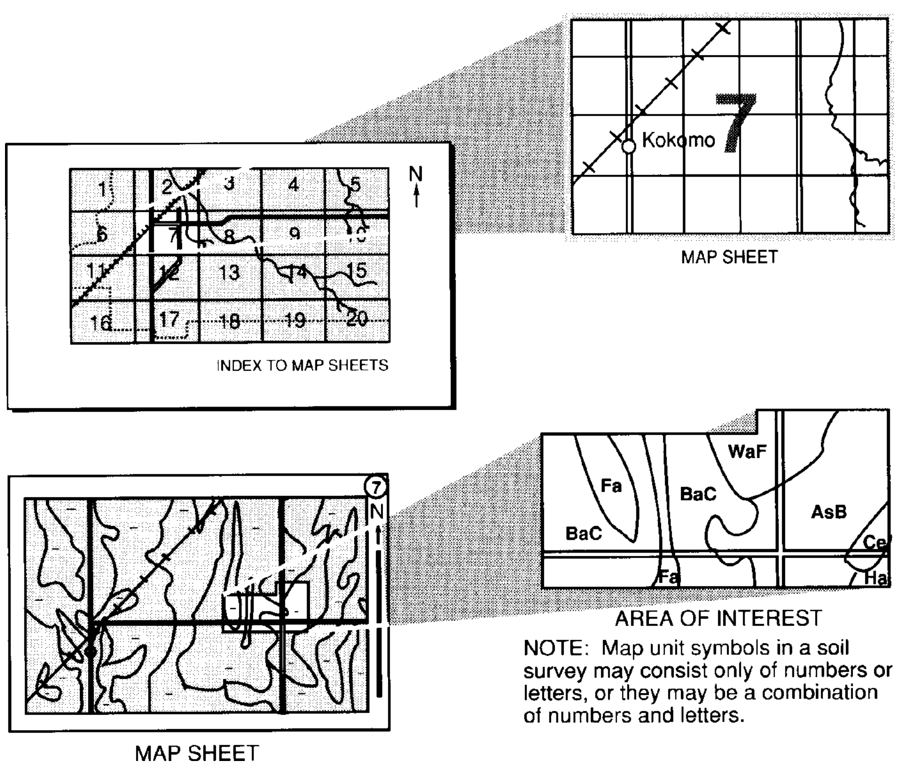
Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, you can locate the Section, Township, and Range by zooming in on the **Index to Map Sheets**, or you can go to the Web Soil Survey at (http://websoilsurvey.nrcs.usda.gov/app/).

Note the map unit symbols that are in that area. The **Contents** lists the map units by symbol and name and shows the page where each map unit is described.

See the Contents for sections of this publication that may address your specific needs.



This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1988. Soil names and descriptions were approved in 1989. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1989. This survey was made cooperatively by the Natural Resources Conservation Service and the Montana Agricultural Experiment Station. It is part of the technical assistance furnished to the Teton County Conservation District and the Pondera County Conservation District.

The most current official data are available through the NRCS Soil Data Mart website at http://soildatamart.nrcs.usda.gov. Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: A typical area of Hanson very cobbly loam, 0 to 4 percent slopes, is in the foreground. Ear Mountain is in the background.

Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at http://www.nrcs.usda.gov.

Contents

Part II

Issued 2003

Index to Taxonomic Units

Index to Map Units

Summary of Tables

For tables with the most current data, please visit the
Soil Data Mart at **http://soildatamart.nrcs.usda.gov/.**

Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at local offices of the Natural Resources Conservation Service or the Cooperative Extension Service.

Dave White
State Conservationist
Natural Resources Conservation Service

Soil Survey of
Choteau-Conrad Area; Parts of Teton and Pondera Counties, Montana

Fieldwork by George B. Hilts, Robert J. Spokas, Rory W. Steinke, and
Steven G. VanFossen, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service,
in cooperation with
the Montana Agricultural Experiment Station

Choteau-Conrad Area; Parts of Teton and Pondera Counties is located in north-central Montana (fig. 1) along the eastern front of the northern Rocky Mountains. The survey area covers about 1,234,200 acres in Teton County and 782,000 acres in Pondera County, totaling 2,016,200 acres, or 3,150 square miles.

The survey area is bounded by the northern Rocky Mountains to the west; Toole County, Birch Creek, and the Marias River to the north; Cascade County and the Sun River to the south; and Chouteau County to the east. Most of the land is privately owned but does include about 149,000 acres in Teton County and 58,000 acres in Pondera County of state and federal lands. The survey area's main drainages are the Marias, Sun, and Teton Rivers and their tributaries.

The survey area includes all of the land within Teton and Pondera Counties except for the Lewis and Clark National Forest and the Blackfeet Indian Reservation. The Blackfeet Indian Reservation in northern Pondera County was included in the 1980 publication, "Soil Survey of Glacier County Area and Part of Pondera County, Montana."

This soil survey updates the surveys "Soils of Teton County," published in 1937, and "Soils of Pondera County," published in 1934. It provides additional information and has larger maps, showing the soils in greater detail.

General Nature of the Survey Area

This section describes some of the environmental and cultural features that affect the use and management of soils in the survey area. These features are history; industry, transportation, and recreation; regional geology; natural resources; physiography and drainage; and climate.

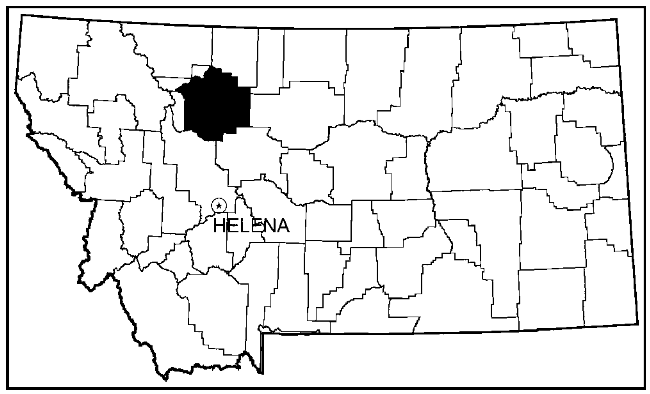


Figure 1.—Location of Choteau-Conrad Area; Parts of Teton and Pondera Counties, Montana

History

In 1806, the Lewis and Clark Expedition traveled through the northwestern part of the survey area. During this time, the Blackfeet Indians were in possession of the area east of the Rocky Mountain Front. In 1867, Fort Shaw was established along the Sun River to protect the immigration of settlers. Soon afterward, cattle and other livestock were driven into the area.

In 1885, the present boundary of the Blackfeet Indian Reservation was established. In 1887, unreserved public lands were opened for settlement. However, not until after 1909, when the Homestead Act went into affect, did the area receive the greatest

influx of settlers. The present boundaries of Teton and Pondera Counties were established in 1919. Oil and gas fields were discovered in 1927. These counties have since developed into one of the most important oil-producing regions in Montana.

The Teton Soil Conservation District was established in 1947, and the Pondera Soil Conservation District was established in 1945. Soil surveys produced between 1947 and 1976 were primarily for conservation planning and were done on a farm-to-farm basis. In June 1976, the Choteau-Conrad Soil Survey Area; Parts of Teton and Pondera Counties was established.

Industry, Transportation, and Recreation

The economy of the area is based primarily on livestock and small-grain production. Large irrigation projects, such as Greenfield, Burton, and Sunnyslope Benches, and Birch Creek Area, greatly add to the overall grain and hay production. Petroleum is obtained from several oil fields; the largest is the Pondera Oil Field near Pendroy. Natural gas is obtained mainly from the Blackleaf Canyon area and the Pondera Oil Field. Timber production is mainly limited to posts, poles, and firewood. Gravelly material for roads is plentiful in the western part of the survey area but is not adequate in the eastern part.

A network of roads and railroads serves the survey area. Major paved roads are U.S. Highways 89 and 287; U.S. Interstate 15; and State Highways 221, 219, 216, and 408. The Burlington Northern Santa Fe Railroad has a main line and branch lines in the area. The main line goes through the communities of Power, Dutton, Brady, and Conrad, and branch lines extend to Fairfield and Choteau. Several community airports are located in the larger communities.

Many recreational activities exist in this survey area. Boating, cross-country skiing, fishing, golfing, hiking, hunting, mountain climbing, and snowmobiling are popular activities. Ponds, reservoirs, and streams provide exceptional boating, fishing, swimming, and water-skiing opportunities. Big game, such as bighorn sheep, black bear, elk, grizzly bear, mountain goat, mountain lion, mule deer, pronghorn antelope, and white-tailed deer, reside here. Upland game birds, including Hungarian partridge, ring-necked pheasant, and sharp-tailed grouse, along with waterfowl, such as duck, geese, and swan, inhabit the area.

Regional Geology

The survey area is underlain by a thick sequence of Cambrian- to Cretaceous-aged sedimentary rocks that range in age from 600-million to 65-million years. These rocks dip gently to the west and consist of both marine and terrestrial sediments. These sediments were deposited on ocean bottoms or coastal plains near the shorelines of ancient inland seas. These shorelines migrated back and forth across what is now central Montana.

The Rocky Mountains were formed during a time of compression and uplift in the early- to mid-Tertiary Period. The extensive folding and faulting, which accompanied the orogeny, uplifted older sediments and placed them in juxtaposition with the relatively flat-lying Cretaceous-aged sediments of the Great Plains. These older sediments lie in a series of closely spaced imbricated thrust blocks that dip steeply to the west.

Overlying the Cretaceous rocks are poorly consolidated, Tertiary-aged lake and streambed sediments; some of which stand out now as elevated terraces. Continental glaciation during the Quaternary Period alternately eroded and deposited large volumes of material on the plains. Thick deposits of glacial drift blanket the northeastern one-third of the survey area. Quaternary-aged alpine glaciers in the Rocky Mountains have deposited lobes of alpine glacial till at the base of the mountains in the western portion of the survey area. Paleozoic rocks are exposed in the Sawtooth Range. These Paleozoic rocks include Cambrian-, Devonian-, and Mississippian-aged sediments and consist primarily of carbonates, including limestone and dolomite, with subordinate amounts of sandstone, siltstone, and shale. These rocks are highly faulted and unconformably overlain by marine and nonmarine shale and sandstone of the Jurassic and lower-Cretaceous Periods.

Because of the complex geology and limited surface exposures, it is not always possible to directly correlate individual soil series with a particular formation. Starley and Whitore soils are typically formed from the Mississippian-aged Madison Limestone. Cheadle, Doby, and Fifer soils are derived from the sandstone and shale of the lower-Cretaceous Kootenai Formation.

The Cretaceous sediments in the Great Plains increase in age from west to east and are described

from oldest to youngest. The oldest exposed unit is the Colorado Group; it has been subdivided in this area to include the lower-Cretaceous Blackleaf Formation and the upper-Cretaceous Marias River Shale. Both consist of marine siltstone and shale with occasional sandstone beds. Salts in the Colorado Group and in portions of the Two Medicine Formation are leached by high ground water and are precipitated on the surface at saline seeps. Typical soils formed from this formation include the Abor, Bascovy, Megonot, Neldore, Tanna, and Yawdim series.

Directly overlying the Colorado Group is the Montana Group. This group consists of the Telegraph Creek Formation, the Virgelle Sandstone, and the Two Medicine Formation. The Telegraph Creek Formation is a sandy shale unit. It outcrops in a thin band west of the Colorado Group, acting as a transitional unit between the shales of the Colorado Group and the overlying Virgelle Sandstone. Typical soils formed from this formation include the Cabbart, Delpoint, and Yamacall series.

The Virgelle Sandstone is a permeable, cross-bedded sandstone that is used extensively as an aquifer. Its upper portion contains titaniferous magnetite and forms a prominent rimrock trending northwest to southeast in the southern portion of the survey area. Typical soils formed from this formation include the Rentsac, Rootel, and Twilight series.

The Two Medicine Formation, conformably overlying the Virgelle Sandstone, is a shaly unit containing sandstone and coal beds. Coal is locally abundant near the base of the formation. During deposition, the ancient shoreline was migrating back and forth across central Montana. The shale and sandstone deposited in a marine environment have a high sodium content, but it is not spread consistently throughout the formation. Typical soils formed from this formation include the Amor, Cabba, Wayden, and Winifred series.

The Two Medicine Formation contains a significant fossil location at Egg Mountain, where a complete nest of Hypsilophondontid eggs was found. Hypsilophondontids were 5-foot long, swift-running dinosaurs that lived in colonies and tended their nests. Lesser amounts of Troodon bones and eggs were also found at the Egg Mountain site. Troodons were a small, swift carnivorous dinosaur.

Small exposures of the Horsethief Sandstone and the Bearpaw Shale, a dark-gray marine shale, outcrop in the western edge of the plains, adjacent to the uplifted thrust belt. The Horsethief Sandstone is a cross-bedded sandstone that also contains deposits of titaniferous magnetite. Neldore soils are closely associated with the Bearpaw Shale. However, there is no particular series associated with the small outcrops of the Horsethief Sandstone.

Overlying the lithified units are unconsolidated Tertiary- and Quaternary-aged sediments, including lake sediments consisting of fine-grained deposits that formed behind temporary ice dams. Typical soils associated with lakebed deposits include the Absher, Creed, Kobase, Marias, Marvan, and Nobe series.

Quaternary streambed deposits of coarse gravel are left as remnant terraces. These remnant terraces are up to 800 feet above the present valley floor. Soils typically associated with gravel terraces are the Crago, Fairfield, Judith, Niart, Rothiemay, Varney, and Windham series.

The continental glacial till in the northeastern portion of the survey area is closely associated with the Hillon, Kevin, Nunemaker, and Scobey series. Within the till are reworked glaciofluvial deposits closely associated with the Ethridge, Kobase, Kremlin, and Marias series. Soils typically associated with the glacial till in the western portion of the survey area include the Babb, Kiev, Tibson, and Winspect series.

Present drainages are filled with unconsolidated Quaternary-aged alluvium that is closely associated with the Binna, Havre, Korchea, Nesda, Ridgelawn, Rivra, Ryell, and Scravo series.

Natural Resources

Teton and Pondera Counties have produced significant quantities of oil and gas since deposits were discovered in the Sweetgrass Arch in the latter part of the 1920s (Perry, 1960). The Sweetgrass Arch is a gentle, north-plunging anticline 150-miles long and 60-miles wide that formed during the mid-Tertiary orogeny. The southwestern tip of the Northern District of the Montana Board of Oil and Gas Conservation extends into the survey area and consists of more than twenty separate oil and gas fields.

Outcrops of moderate to good quality, bituminous coal are widely distributed throughout the survey area, but the total volume is small. Small quantities have been excavated in the past, and some property owners mine small volumes for personal use. However, the deposits have not proven to be economically valuable, at least for present market conditions. The region was originally believed to contain significant economically recoverable coal deposits because of its similarity to other major coal-producing areas of Montana. However, in this area,

the beds are thinner and contain significant clay partings that limit the use of mechanized mining and separation.

There are no major mineral mining districts within the survey area, as there are in Lewis and Clark County to the southwest. However, small volumes of titanium, iron, and zircon have been produced from the titaniferous magnetite bed in the upper Virgelle Sandstone of Section 18, Township 25 North, Range 5 West.

Much of the ground water that has been developed within the survey area has been produced from unconsolidated Tertiary and Quaternary alluvial deposits (Noble and others, 1982). These sources consist of gravel terraces, old lakebeds, and alluvial fans and can produce significant quantities of good quality water. Recharge is a function of precipitation infiltration. In some areas, recharge is heavily dependent on canal seepage loss during the irrigation season. Alluvium typically yields more water to wells than other types of aquifers. However, aquifers that are formed in alluvium are susceptible to contamination and overuse. Pesticides have been found in some wells in Teton County, although the concentrations were generally below the health-advisory levels proposed by the Environmental Protection Agency for drinking water.

The bedrock ground water regime can generally be divided along a north-south line near the center of the survey area at the outcrop of the Virgelle Sandstone. The rocks to the west of this outcrop lie stratigraphically above the Virgelle Sandstone; therefore wells can be drilled through the overlying formations to intersect it. The Virgelle Sandstone is the primary aquifer in the northwestern Great Plains and contains water of good to moderate quality. Dissolved solids are generally in the range of 1,000mg/L. Wells yielding up to 250 gpm have been developed in the Virgelle Sandstone, although they generally average less than 50 gpm. The Colorado Group lies to the east of the surface exposure of the Virgelle Sandstone. This marine shale is over 2,500-feet thick and contains small volumes of highly mineralized water. Some water has been developed from sandy units within the Colorado Group, but, in general, the water is not suitable for domestic or stock use.

Physiography and Drainage

Teton and Pondera Counties overlie parts of two physiographic provinces, the Rocky Mountain Province and the Great Plains Province, which are separated by a 1- to 2-mile wide transitional zone of foothills. The Sawtooth Range is the easternmost range in the Rocky Mountain Province and lies at the western margin of the survey area. It is composed of a mountainous, northwestern-trending belt approximately 3-miles wide, with narrow, linear valleys and high peaks. The survey area begins at the transitional foothills and does not include the high peaks of the Sawtooth Range.

The plains and rolling hills to the east of the Sawtooth Range are included within the Great Plains Province and can be further divided into glaciated and unglaciated regions of the Missouri Plateau. The boundary between the two regions is irregular and trends northwest to southeast in the eastern third of the survey area. The glaciated area is to the northeast.

Surface elevations range from 8,875 feet at Mount Wright to 3,200 feet at the eastern border. The Sawtooth Range contains numerous peaks ranging from 7,500 to 8,500 feet. The Sawtooth Range extends from the Continental Divide at the border of Pondera and Flathead Counties to the foothills 3 miles to the east. The transitional foothills have an average elevation of 5,000 feet. The plains slope gently to the east to a minimum elevation of 3,200 feet.

The survey area is bounded on the north by the Marias River, bounded on the south by the Sun River, and bisected by the Teton River. All three rivers flow to the east where they eventually join the Missouri River. They all have tributaries within Teton and Pondera Counties.

Numerous short tributaries in the Sawtooth Range flow south into the Sun River. Below the Sawtooth Range, there are few drainages entering the river. Water is diverted into a system of canals, including the USRS, Floweree, and Greenfield. The two major dams on the Sun River are Gibson Dam, west of the survey area in the Sawtooth Range, and Diversion Dam, which diverts water into Pishkun Reservoir. These are the only dams on the three major rivers in the survey area. However, many small dams and diversion structures have been constructed on the tributaries of the major rivers.

The Teton River and its tributaries drain the central portion of the survey area. The Teton River drainage includes Willow and Deep Creeks, flowing from the south, and Blackleaf and Muddy Creeks, flowing from the north. Water is diverted from the Teton River to feed the Bynum, Eureka, and Harvey Reservoirs. The Teton River drainage contains two swamps, Blackleaf and Pine Butte, immediately adjacent to the foothills. Muddy Creek drains Blackleaf Swamp, north of the Teton River. McDonald Creek and the North Fork of

Willow Creek drain Pine Butte Swamp, south of the Teton River.

The Marias River drains the northern half of the survey area, including most of Pondera County. Its major tributaries include Badger and Two Medicine Creeks at the western end, Birch and Dupuyer Creeks in the central portion, and the Dry Fork of the Marias River at the northeastern end. Pondera Coulee and Spring Creek flow east toward the Marias River in the eastern portion of the area. Near the western edge of the survey area, Swift Dam was constructed on Birch Creek. Water is diverted from Birch and Dupuyer Creeks to form Lake Francis.

Climate

Summers in the survey area are pleasant, with cool nights; moderately warm, sunny days; and little hot or humid weather. Most summer rainfall occurs as showers or thunderstorms, but steady rains may occur during late spring or early summer. Temperatures rarely reach a high of 100 degrees F. An average year will have only 15 days with maximums of 90 degrees F or higher. Weather stations in the area show freezing temperatures do not occur in July or August, rarely in June, and only a few days in May or September. During April and October, frost often occurs along the mountain fronts and in valleys.

Winters are not as cold as expected for continental locations at this latitude, mainly because of Chinook winds for which the survey area is noted. Normally, subzero weather only occurs several times during winter; the coldest weather seldom lasts more than a few days at a time. Cold temperatures cease when Chinook winds arrive from the southwest. These winds can produce sharp temperature rises of 40 degrees F or more in a 24-hour period. Because of recurring Chinook winds throughout the winter season, snow seldom accumulates to any great depth. The ground is generally bare, or nearly bare, of snow during most of the winter, except in the mountain fronts and higher foothills. Invasions of cold air from the polar regions occur a few times each winter. From mid-December to March, sharp temperature falls are observed, from above freezing to below zero, within a 24-hour period.

On the following pages are climate tables for the period 1961 to 1990 for the survey area. The “Temperature and Precipitation” table gives data for the survey area as recorded at Blackleaf, Choteau Airport, Conrad, Fairfield, and Valier. The “Freeze Dates in Spring and Fall” table shows probable dates of the first freeze in fall and the last freeze in spring. The “Growing Season” table provides data on probable length of the growing season.

Growing-degree days, as shown in the “Temperature and Precipitation” table, are equivalent to heat units. During the month, growing-degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal growing-degree accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

In areas having wide variations in elevation and irregular topographic features, differences in the amount of precipitation are considerable. Generally, precipitation falls as snow during late fall, winter, and early spring. Rain can occur in any month. Late-spring, summer, and early-fall precipitation is usually rain, but hail occasionally occurs during summer thunderstorms. The wettest areas are along the mountains.

Although the survey area’s mean annual precipitation would normally classify the area as semiarid, it is important to note that about 70 percent of the annual total precipitation normally falls during the April to September growing season. The combination of ideal temperatures during the peak of the growing season, long hours of summer sunshine, and nearly 10 inches of precipitation during the 6 critical months, makes the climate favorable for dryland farming. Heavy fog seldom occurs. Average wind speed is relatively high, but winds over 70 mph seldom occur. Visibility is normally excellent.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. This information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the

geology, landforms, relief, climate, and natural vegetation of the survey area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, soil scientists develop a concept, or model, of how the soils were formed. During mapping, this model enables soil scientists to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge into one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size, and shape of soil aggregates; kind and amount of rock fragments; distribution of plant roots; reaction; and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret data from these analyses and tests as well as field-observed characteristics and soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data for crop yields under high levels of management are modeled and validated with farm records and field or plot information on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Descriptions, names, and delineations of the soils in this survey area may not fully agree with those of the soils in adjacent survey areas. Differences result from a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

Temperature and Precipitation

(Recorded in the period 1961-1990 at Blackleaf, Choteau Airport, Conrad, Fairfield, and Valier)

Month	Temperature (Degrees F)						Precipitation (Inches)				
	Average Daily Maximum	Average Daily Minimum	Average	2 years in 10 Will Have— Maximum Temperature More Than	2 years in 10 Will Have— Minimum Temperature Less Than	Average Number of Growing Degree Days*	Average	2 years in 10 Will Have— Less Than	2 years in 10 Will Have— More Than	Average Number of Days With 0.10 or More	Average Total Snowfall
BLACKLEAF:											
January----	33.2	8.6	20.9	61	-31	16	0.54	0.20	0.82	2	9.6
February---	38.1	13.5	25.8	65	-26	19	0.53	0.16	0.82	1	8.3
March------	42.2	18.4	30.3	66	-19	25	0.73	0.31	1.08	2	8.4
April------	52.9	27.5	40.2	78	2	108	1.21	0.34	1.99	3	7.5
May--------	62.0	36.0	49.0	83	18	280	2.46	1.21	3.54	5	1.5
June-------	71.1	43.6	57.4	90	25	505	2.41	0.99	3.61	5	0.1
July-------	79.1	47.1	63.1	94	34	694	1.35	0.46	2.09	3	0.0
August-----	78.5	45.8	62.1	95	31	677	1.71	0.51	2.69	4	0.0
September--	67.8	37.6	52.7	90	19	381	1.24	0.33	1.96	3	1.3
October----	58.7	29.7	44.2	81	2	189	0.55	0.16	0.86	1	2.5
November---	43.3	19.1	31.2	70	-17	37	0.44	0.15	0.71	1	6.8
December---	34.3	10.3	22.3	61	-31	13	0.57	0.19	0.88	2	9.6
Yearly:											
Average----	55.1	28.1	41.6	---	---	---	---	---	---	---	---
Extreme----	102.0	-42.0	---	97	-36	---	---	---	---	---	---
Total------	---	---	---	---	---	2,944	13.73	9.32	16.78	32	55.6
Average number of days per year with at least 1 inch of snow on the ground--34											
CHOTEAU AIRPORT:											
January----	33.3	11.8	22.6	61	-28	21	0.29	0.08	0.47	0	7.3
February---	39.6	17.1	28.3	65	-19	30	0.22	0.07	0.36	0	5.4
March------	45.4	22.3	33.8	69	-12	54	0.38	0.13	0.59	1	6.9
April------	56.0	30.9	43.5	80	8	172	0.80	0.27	1.28	2	5.8
May--------	65.7	39.9	52.8	86	25	401	1.99	0.84	2.96	4	1.0
June-------	74.5	47.9	61.2	93	34	634	2.18	0.95	3.24	4	0.0
July-------	82.4	52.1	67.2	96	41	842	1.31	0.47	2.01	3	0.0
August-----	81.3	50.8	66.0	97	37	807	1.34	0.52	2.11	3	0.0
September--	70.3	42.5	56.4	91	25	503	1.02	0.23	1.65	2	1.4
October----	60.9	35.2	48.0	83	10	287	0.42	0.11	0.73	1	2.3
November---	44.2	23.3	33.8	70	-12	63	0.33	0.07	0.59	0	6.2
December---	35.1	14.9	25.0	61	-26	21	0.36	0.13	0.55	1	7.2
Yearly:											
Average----	57.4	32.4	44.9	---	---	---	---	---	---	---	---
Extreme----	103.0	-43.0	---	98	-32	---	---	---	---	---	---
Total------	---	---	---	---	---	3,833	10.65	7.67	13.31	21	43.2
Average number of days per year with at least 1 inch of snow on the ground--45											

See footnote at end of table.

Temperature and Precipitation--Continued

Month	Temperature (Degrees F): Average Daily Maximum	Average Daily Minimum	Average	2 years in 10 Will Have— Maximum Temperature More Than	2 years in 10 Will Have— Minimum Temperature Less Than	Average Number of Growing Degree Days*	Precipitation (Inches): Average	2 years in 10 Will Have— Less Than	2 years in 10 Will Have— More Than	Average Number of Days With 0.10 or More	Average Total Snowfall
CONRAD:											
January----	31.2	6.6	18.9	60	-30	10	0.51	0.17	0.78	1	8.1
February---	38.1	12.7	25.4	65	-23	13	0.32	0.10	0.50	1	4.2
March------	45.0	18.9	31.9	70	-17	35	0.67	0.21	1.08	2	6.2
April------	56.9	28.0	42.5	81	4	148	0.96	0.35	1.58	3	5.1
May--------	66.8	37.8	52.3	88	21	387	2.11	1.13	2.97	5	0.3
June-------	74.8	45.8	60.3	93	31	607	2.24	1.03	3.28	5	0.1
July-------	81.9	49.3	65.6	96	36	794	1.23	0.39	1.92	3	0.0
August-----	81.4	48.1	64.7	98	35	759	1.39	0.48	2.14	3	0.0
September--	70.6	38.9	54.7	92	22	450	1.07	0.29	1.76	2	0.5
October----	61.0	30.1	45.6	84	4	225	0.47	0.11	0.79	1	1.4
November---	43.8	17.7	30.8	70	-16	36	0.45	0.17	0.75	1	5.0
December---	33.4	9.1	21.3	61	-33	9	0.49	0.16	0.77	2	6.9
Yearly:											
Average----	57.1	28.6	42.8	---	---	---	---	---	---	---	---
Extreme----	105.0	-46.0	---	99	-36	---	---	---	---	---	---
Total------	---	---	---	---	---	3,472	11.91	8.11	15.17	29	37.8
Average number of days per year with at least 1 inch of snow on the ground--9											
FAIRFIELD:											
January----	32.3	11.6	22.0	59	-27	16	0.45	0.15	0.72	1	8.6
February---	39.6	16.8	28.2	64	-20	25	0.28	0.09	0.43	0	5.8
March------	46.0	21.8	33.9	69	-13	52	0.66	0.31	0.95	2	9.6
April------	56.5	30.3	43.4	80	8	170	1.05	0.29	1.66	3	6.9
May--------	65.8	39.3	52.5	86	24	394	2.38	1.17	3.44	5	1.3
June-------	73.9	47.0	60.5	92	33	613	2.23	0.98	3.30	4	0.2
July-------	81.3	51.0	66.1	94	40	809	1.39	0.49	2.21	3	0.0
August-----	80.9	50.2	65.6	96	37	792	1.53	0.55	2.43	3	0.0
September--	70.8	41.9	56.4	91	25	496	1.22	0.38	1.91	3	1.9
October----	61.1	34.8	47.9	83	10	285	0.53	0.20	0.95	1	1.9
November---	44.3	23.1	33.7	68	-11	62	0.36	0.14	0.59	1	6.7
December---	34.3	14.1	24.2	59	-28	17	0.41	0.18	0.60	1	8.5
Yearly:											
Average----	57.2	31.8	44.5	---	---	---	---	---	---	---	---
Extreme----	103.0	-44.0	---	97	-32	---	---	---	---	---	---
Total------	---	---	---	---	---	3,733	12.48	9.38	15.35	27	51.5
Average number of days per year with at least 1 inch of snow on the ground--54											

See footnote at end of table.

Temperature and Precipitation--Continued

Month	Temperature (Degrees F)					Precipitation (Inches)					
	Average Daily Maximum	Average Daily Minimum	Average	2 years in 10 Will Have— Maximum Temperature More Than	2 years in 10 Will Have— Minimum Temperature Less Than	Average Number of Growing Degree Days*	Average	2 years in 10 Will Have— Less Than	2 years in 10 Will Have— More Than	Average Number of Days With 0.10 or More	Average Total Snowfall
VALIER:											
January----	30.8	9.2	20.0	58	-28	13	0.38	0.14	0.58	1	6.5
February---	37.2	14.3	25.8	63	-23	16	0.28	0.11	0.41	0	4.1
March------	43.3	20.0	31.7	66	-16	33	0.53	0.16	0.82	1	4.8
April------	54.9	29.2	42.0	79	6	142	0.89	0.33	1.46	2	4.7
May--------	64.8	38.7	51.7	85	22	370	2.18	1.07	3.15	4	0.5
June-------	73.3	46.6	59.9	91	33	598	2.48	1.09	3.67	5	0.0
July-------	80.6	50.7	65.6	95	39	793	1.42	0.39	2.24	3	0.0
August-----	80.0	49.7	64.9	95	37	771	1.60	0.52	2.49	3	0.0
September--	69.3	41.0	55.1	90	24	460	1.20	0.30	1.91	3	0.5
October----	59.7	33.5	46.6	81	8	251	0.49	0.20	0.80	1	0.9
November---	42.5	21.2	31.9	68	-13	44	0.36	0.13	0.56	1	4.3
December---	32.7	12.1	22.4	59	-28	12	0.36	0.14	0.54	1	5.6
Yearly:											
Average----	55.8	30.5	43.1	---	---	---	---	---	---	---	---
Extreme----	103.0	-42.0	---	97	-33	---	---	---	---	---	---
Total------	---	---	---	---	---	3,504	12.17	8.90	15.21	25	31.7

Average number of days per year with at least 1 inch of snow on the ground--49

* A growing-degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (Threshold: 40.0 degrees F).

Freeze Dates in Spring and Fall

(Recorded in the period 1961-1990 at Blackleaf, Choteau Airport, Conrad, Fairfield, and Valier)

Probability	Temperature		
	24 Degrees F or Lower	28 Degrees F or Lower	32 Degrees F or Lower
BLACKLEAF:			
Last freezing temperature in spring: January-July			
1 year in 10 later than-------	May 15	June 8	June 28
2 years in 10 later than------	May 10	June 1	June 21
5 years in 10 later than------	April 30	May 19	June 6
First freezing temperature in fall: August-December			
1 year in 10 earlier than-----	September 10	September 2	August 21
2 years in 10 earlier than----	September 16	September 7	August 26
5 years in 10 earlier than----	September 27	September 15	September 4
CHOTEAU AIRPORT			
Last freezing temperature in spring: January-July			
1 year in 10 later than-------	May 6	May 15	June 1
2 years in 10 later than------	May 1	May 10	May 27
5 years in 10 later than------	April 21	May 2	May 18
First freezing temperature in fall: August-December			
1 year in 10 earlier than-----	September 25	September 13	September 5
2 years in 10 earlier than----	October 1	September 19	September 10
5 years in 10 earlier than----	October 12	October 1	September 19

Freeze Dates in Spring and Fall--Continued

Probability	Temperature		
	24 Degrees F or Lower	28 Degrees F or Lower	32 Degrees F or Lower
CONRAD:			
Last freezing temperature in spring: January-July			
1 year in 10 later than-------	May 11	May 24	June 13
2 years in 10 later than------	May 6	May 20	June 7
5 years in 10 later than------	April 28	May 13	May 28
First freezing temperature in fall: August-December			
1 year in 10 earlier than-----	September 17	September 6	August 27
2 years in 10 earlier than----	September 22	September 11	September 1
5 years in 10 earlier than----	October 2	September 21	September 11
FAIRFIELD:			
Last freezing temperature in spring: January-July			
1 year in 10 later than-------	May 6	May 16	June 2
2 years in 10 later than------	May 1	May 12	May 29
5 years in 10 later than------	April 21	May 3	May 20
First freezing temperature in fall: August-December			
1 year in 10 earlier than-----	September 24	September 13	September 2
2 years in 10 earlier than----	October 1	September 20	September 8
5 years in 10 earlier than----	October 13	October 2	September 19
VALIER:			
Last freezing temperature in spring: January-July			
1 year in 10 later than-------	May 7	May 14	June 2
2 years in 10 later than------	May 2	May 11	May 29
5 years in 10 later than------	April 23	May 5	May 20
First freezing temperature in fall: August-December			
1 year in 10 earlier than-----	September 21	September 12	September 2
2 years in 10 earlier than----	September 27	September 17	September 7
5 years in 10 earlier than----	October 9	September 28	September 17

Growing Season

(Recorded in the period 1961-1990 at Blackleaf, Choteau Airport, Conrad, Fairfield, and Valier)

Probability	Daily Minimum Temperature		
	Higher Than 24 Degrees F	Higher Than 28 Degrees F	Higher Than 32 Degrees F
	Days	*Days*	*Days*
BLACKLEAF:			
9 years in 10	127	97	66
8 years in 10	134	104	75
5 years in 10	149	119	91
2 years in 10	163	133	108
1 year in 10	171	140	117
CHOTEAU AIRPORT:			
9 years in 10	147	126	101
8 years in 10	156	135	108
5 years in 10	174	151	122
2 years in 10	191	168	136
1 year in 10	200	177	144
CONRAD:			
9 years in 10	134	112	81
8 years in 10	141	118	89
5 years in 10	156	130	105
2 years in 10	170	141	122
1 year in 10	178	147	130
FAIRFIELD:			
9 years in 10	146	126	99
8 years in 10	156	134	106
5 years in 10	174	151	120
2 years in 10	192	167	135
1 year in 10	202	175	142

Growing Season--Continued

Probability	Daily Minimum Temperature		
	Higher Than 24 Degrees F	Higher Than 28 Degrees F	Higher Than 32 Degrees F
	Days	*Days*	*Days*
VALIER:			
8 years in 10------------	155	132	105
5 years in 10------------	168	145	119
2 years in 10------------	182	157	133
1 year in 10-------------	190	163	140

Formation and Classification of the Soils

This section relates the soils in the survey area to the major factors of soil formation and describes the system of soil classification. The tables, “Classification of the Soils” and “Acreage and Proportionate Extent of the Soils,” at the end of this section show the classification and extent of the soils in this survey area.

Formation of the Soils

Soil is a natural, three-dimensional body on the earth’s surface. Soil has properties that result from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over a period of time.

Although there are many different soils, each soil is the result of the interaction of the same five factors. These factors are the effect of climate on the parent material, the kinds of plants and organisms living in the soil, the relief of the land, the physical and chemical composition of the parent material, and the length of time it took for the soil to form.

Within short distances, the combination of these factors varies, and, consequently, the soils that form differ in fertility, productivity, and physical and chemical characteristics. In the following paragraphs, the factors of soil formation are discussed as they relate to the soils in the survey area.

Climate

Temperature and precipitation mainly determine climate, an active force in the formation of soils, although wind has some influence. Soils form in rocks that have been broken into suitable materials by erosion and alternate freezing and thawing. Chemical reactions, such as solution and hydration, further break down this weathered material.

Precipitation and temperature affect the kind and amount of vegetation that grows on the soil. Vegetation decays to produce organic matter in the soil. Soils that have cool temperatures and high precipitation generally contain more organic matter and are dark colored. Soils that have warm temperatures and low precipitation generally contain less organic matter and are light colored.

In this survey area, the annual precipitation ranges from about 10 to 24 inches.

Living Organisms

Living organisms are active in the formation of soils. Plants, animals, insects, and microorganisms affect gains or losses in organic matter, plant nutrients, and changes in porosity and structure.

Organic matter is the main source of the dark color of the surface layer. However, some soils, such as those in the Winifred series, get their dark color from dark minerals as well as from organic matter. Roots, rodents, and insects penetrate the soil and alter its structure. Microorganisms, chemicals in the soil, and insects change leaves, roots, and entire plants that remain in the surface layer to humus. Among the earliest inhabitants of rock material, fungi and algae contribute to the decomposition of bedrock. Animals increase porosity by burrowing through the soil and leaving open channels for the movement of water and air. Common burrowing animals in the area are badger, ground squirrel, mice, and rabbit.

Vegetation in the survey area ranges from short grasses, mid grasses, and shrubs in most areas to Douglas-fir, lodgepole pine, and quaking aspen in the foothills and mountainous areas.

Topography

Topography, or relief, is determined by glaciation and mountain formation and by the age and resistance of geologic formations to erosion by wind and water. Topography influences soil development through its effect on drainage and runoff. On eroded uplands in the survey area, runoff water has carved deep valleys into the bedrock formations. The rugged relief contrasts sharply with the nearly level relief of the terraces and flood plains of the river valleys. On uplands, the number and distinctness of soil horizons generally decrease as the slope increases. Exceptions to this are the soils of the Burnette and

Loberg series that formed on steep mountainsides. Soils on steep slopes that have rapid runoff have many characteristics similar to those of soils formed in arid climates. Level soils that receive runoff water from overlying areas have many of the characteristics of soils that formed in humid climates. Examples of this pattern are the shallow Cabbart soils that have steep slopes and the deep Tetonview soils in subirrigated depressions. Cabbart soils have thin, light-colored A horizons, and Tetonview soils have thick, dark-colored A horizons.

The topography of the survey area closely affects the local microclimate. The amount of precipitation and air temperatures can have wide variations within short distances.

In the mountains, generally, depth to bedrock, amount of rock fragments, and number and distinctness of soil horizons are affected by steepness and shape of slope. Soils on steep convex slopes generally have a greater amount of rock fragments, are shallower to bedrock, and have fewer and less distinct soil horizons. In the valleys, the number and distinctness of soil horizons generally decrease as the slope increases.

Parent Material

About 45 percent of the soils in the survey area formed in glacial till or in glacial outwash material. Some of the soils formed in alluvium derived from mixed sources, and other soils formed in material that weathered from limestone, mudstone, sandstone, shale, or siltstone. Soils, such as the Twilight series, that formed in soft sandstone are generally sandy. Soils, such as the Rentsac series, that formed over hard rock are generally loamy and have a high content of rock fragments. Soils, such as the Cabbart and the Delpoint series, that formed in soft shale or siltstone are generally loamy. Soils, such as the Bascovy and the Neldore series, that formed in clay shale are generally clayey. Soils that formed in alluvium range from sandy, such as the Ryell series, to loamy, such as the Havre series, to extremely gravelly, such as the Rivra series.

Time

Change taking place in soils over a long period is called soil genesis. As a result of these changes, distinct horizons, or layers, develop in the soils. The length of time that parent materials have been in place and exposed to climate and living organisms is generally reflected in the degree to which the soil profile has developed. The kind and arrangement of these horizons are called soil morphology. These layers are described in terms of chemistry, color, consistence, permeability, structure, texture, and thickness.

Soils are classified according to their approximate age, from young to mature. Age, or maturity, of a soil is generally indicated by the thickness and distinctness of subsurface horizons, content of organic matter and clay, depth to which soluble material is leached, and form and distribution of calcium carbonate and gypsum in the soil.

Havre loam, a soil of the Entisol order, is a young soil on a flood plain adjacent to a flowing stream. This soil contains little organic matter with which to form an A horizon and no clay accumulation. Little translocation of carbonates has occurred to form Bk horizons.

Evanston soil formed in parent material similar to, but much older than, that of the Havre soil. Evanston soil formed in alluvium on uplands and is a mature soil of the Mollisol order. It contains enough organic matter to have a dark A horizon. Also, it has a distinct clay accumulation in a Bt horizon, and nearly all of the carbonates have been leached from the solum.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1975 and 1987). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. The table, “Classification of the Soils,” shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol, from *mollis*, meaning soft.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Boroll *(Bor,* meaning northern, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature

regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Calciborolls (*Calci*, meaning lime, plus *boroll,* the suborder of the Mollisols that are cool).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Calciborolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed Typic Calciborolls.

SERIES. The series consists of soils within a family that have horizons similar in arrangement in the profile, color, consistence, mineral and chemical composition, reaction, structure, and texture. An example is the Kiev series. The soils in the Kiev series are fine-loamy, mixed Typic Calciborolls.

Soil Series and Detailed Soil Map Units

In this section, arranged in alphabetical order, each soil series recognized in the survey area is described. Each description is followed by the detailed soil map units associated with the series.

Characteristics of the soil and the material in which it formed are identified for each soil series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the “Soil Survey Manual” (Soil Survey Division Staff, 1962). Many of the technical terms used in the descriptions are defined in “Soil Taxonomy” (Soil Survey Staff, 1975). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units delineated on the detailed soil maps in this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class, there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The contrasting components are mentioned in the map unit descriptions. A few areas of minor components may not have been observed, and, consequently, they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all of the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all of the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is

divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Kobase silty clay loam, 0 to 4 percent slopes, is a phase of the Kobase series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

This survey includes *complexes.* They consist of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Kobase-Marias complex, 0 to 4 percent slopes, is an example.

This survey includes *miscellaneous areas*. They have little or no soil material and support little or no vegetation. Pits, gravel, is an example.

The "Acreage and Proportionate Extent of the Soils" table in Parts I and II of the manuscript gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. Many of the terms used in describing the soils or miscellaneous areas are defined in the "Glossary."

Abor Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Very slow
Landform: Hills and sedimentary plains
Parent material: Residuum from semiconsolidated shale
Slope range: 2 to 35 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic, frigid Leptic Udic Haplusterts

Typical Pedon

Abor silty clay, in an area of Linnet-Abor silty clays, 2 to 8 percent slopes, in an area of nonirrigated cropland, 2,400 feet north and 850 feet east of the southwest corner of sec. 2, T. 23 N., R. 2 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; strong fine and medium granular structure; hard, friable, very sticky, moderately plastic; common fine roots; common fine pores; slightly effervescent in spots; slightly alkaline; clear smooth boundary.

Bss—5 to 14 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, very sticky, moderately plastic; common fine roots; common very fine and fine tubular pores; few faint shiny grooved slickensides that intersect at a 30 to 60 degree angle; strongly effervescent; slightly alkaline; clear smooth boundary.

Bssk—14 to 26 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; extremely hard, firm, very sticky, moderately plastic; common very fine roots; few fine tubular pores; common faint shiny grooved slickensides that intersect at a 30 to 60 degree angle; few fine soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bky—26 to 30 inches; mixed grayish brown (2.5Y 5/2) and olive gray (5Y 4/2) clay, dark grayish brown (2.5Y 4/2) and olive gray (5Y 4/2) moist; few fine yellowish brown (10YR 5/4) rust mottles; massive; extremely hard, firm, very sticky, moderately plastic; few very fine roots; few very fine tubular pores; 50 percent hard, weathered shale fragments; few fine soft masses of lime; common fine soft threads of gypsum crystals; strongly effervescent; slightly alkaline; gradual wavy boundary.

Cr1—30 to 38 inches; olive gray (5Y 5/2) semiconsolidated platy shale, olive gray (5Y 5/2) moist; few fine soft masses of gypsum crystals between shale fragments; slightly effervescent between shale fragments; neutral; gradual wavy boundary.

Cr2—38 to 60 inches; olive (5Y 5/3) semiconsolidated shale; slightly acid.

Range in Characteristics

Soil temperature: 42 to 47 degrees F; summer temperatures of 60 to 72 degrees F
Depth to the Bk horizon: 10 to 20 inches
Depth to bedrock: 20 to 40 inches
Other features: These soils have cracks that extend to the paralithic contact and are as wide as 1/4 inch to 3 inches at the surface and are open for 150 days or less. Some pedons have a Bssky horizon.

Ap horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 1 to 4 (The 1 chroma are inherent from the parent material.)
Texture: Silty clay or silty clay loam
Clay content: 35 to 55 percent
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 7.4 to 8.4

Bss horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 1 to 4
Texture: Silty clay, silty clay loam, or clay
Clay content: 35 to 60 percent
Electrical conductivity: 0 to 4 mmhos/cm
Slickensides: Few to common
Reaction: pH 7.4 to 9.0

Bssk horizon
Hue: 2.5YR, 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 1 to 4
Texture: Silty clay, silty clay loam, clay loam, or clay
Clay content: 35 to 60 percent
Slickensides: Few to common
Electrical conductivity: 0 to 4 mmhos/cm
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 9.0

Bky horizon
Hue: 2.5YR, 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 1 to 4
Texture: Silty clay, silty clay loam, or clay
Clay content: 35 to 60 percent
Electrical conductivity: 0 to 4 mmhos/cm
Gypsum: 1 to 5 percent
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 9.0

170C—Abor-Yawdim silty clay loams, 4 to 15 percent slopes

Setting

Landform:
- Yawdim—Hills
- Abor—Hills

Position on landform:
- Abor—Footslopes and toeslopes
- Yawdim—Backslopes and shoulders

Slope:
- Abor—4 to 15 percent
- Yawdim—4 to 15 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Abor and similar soils: 50 percent
Yawdim and similar soils: 35 percent

Minor Components
Kobase and similar soils: 0 to 4 percent
Tanna and similar soils: 0 to 3 percent
Bascovy and similar soils: 0 to 2 percent
Linnet and similar soils: 0 to 2 percent
Marvan and similar soils: 0 to 2 percent
Neldore and similar soils: 0 to 2 percent

Major Component Description

Abor
Surface layer texture: Silty clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.7 inches

Yawdim
Surface layer texture: Silty clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Interbedded shale and siltstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

170E—Abor-Yawdim silty clay loams, 15 to 35 percent slopes

Setting

Landform:
- Abor—Hills
- Yawdim—Hills

Position on landform:
- Abor—Backslopes and footslopes
- Yawdim—Backslopes and shoulders

Slope:
- Abor—15 to 35 percent
- Yawdim—15 to 35 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Abor and similar soils: 45 percent
Yawdim and similar soils: 40 percent

Minor Components
Tanna and similar soils: 0 to 5 percent
Bascovy and similar soils: 0 to 4 percent
Neldore and similar soils: 0 to 4 percent
Linnet and similar soils: 0 to 2 percent

Major Component Description

Abor
Surface layer texture: Silty clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.7 inches

Yawdim
Surface layer texture: Silty clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Interbedded shale and siltstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Absher Series

Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Permeability: Very slow
Landform: Alluvial fans and stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic Typic Natriboralfs

Typical Pedon

Absher clay loam, in an area of Gerdrum-Absher clay loams, 0 to 2 percent slopes, in an area of rangeland, 1,500 feet north and 2,300 feet east of the southwest corner of sec. 5, T. 23 N., R. 2 W.

E—0 to 2 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure parting to moderate fine granular; slightly hard, very friable, slightly sticky, slightly plastic; common fine roots; common vesicular pores; many unstained silt and sand grains; slightly alkaline; abrupt smooth boundary.

Btn1—2 to 4 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; strong medium columnar structure parting to moderate medium subangular blocky; extremely hard, very firm, moderately sticky, moderately plastic; common very fine and fine roots; few very fine tubular pores; light grayish brown (10YR 6/2) coats of unstained sand and silt grains on tops of columns; common distinct clay films on faces of peds; moderately alkaline; clear smooth boundary.

Btn2—4 to 9 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; strong medium prismatic structure parting to moderate fine blocky; extremely hard, firm, moderately sticky, moderately plastic; common very fine and fine roots; common very fine tubular pores; common distinct clay films on faces of peds; moderately alkaline; clear smooth boundary.

Btknyz—9 to 14 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist;

strong medium prismatic structure parting to moderate fine blocky; extremely hard, firm, moderately sticky, moderately plastic; common very fine and fine roots; common very fine tubular pores; few faint clay films on faces of peds; few fine soft masses of lime; common fine soft seams and masses of gypsum and salt crystals; moderately alkaline; clear smooth boundary.

Bknyz1—14 to 36 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm, moderately sticky, moderately plastic; few very fine roots; common very fine pores; common fine soft masses of lime; many fine soft seams and masses of gypsum and salt crystals; strongly alkaline; gradual wavy boundary.

Bknyz2—36 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, moderately sticky, moderately plastic; common fine soft masses of lime; common fine soft threads of gypsum and salt crystals; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F; summer temperatures of 60 to 68 degrees F
Depth to the Btknyz horizon: 6 to 20 inches; mainly 8 to 15 inches.
Phases: Wet

E horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 6 or 7 dry; 3 to 5 moist
Chroma: 1 to 3
Texture: Clay loam mixed to 7 inches (uncultivated areas have a thin A horizon that is a loam or silt loam)
Clay content: 27 to 40 percent
Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent pebbles
Electrical conductivity: 4 to 8 mmhos/cm
Reaction: pH 6.6 to 8.4

Btn horizons
Hue: 2.5Y, 10YR, or 7.5YR
Value: 4 to 6 dry; 4 or 5 moist
Chroma: 1 to 3
Texture: Silty clay, clay, or clay loam
Clay content: 35 to 60 percent
Structure: Moderate, strong columnar, or prismatic
Consistence: Very hard or extremely hard when dry
Content of rock fragments: 0 to 15 percent pebbles
Electrical conductivity: 8 to 16 mmhos/cm
Sodium adsorption ratio: 18 to 70
Reaction: pH 6.6 to 9.0

Btknyz horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 4 to 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Clay loam, clay, or silty clay
Clay content: 35 to 50 percent
Content of rock fragments: 0 to 20 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 16 to 30 mmhos/cm
Sodium adsorption ratio: 18 to 70
Gypsum: 1 to 5 percent
Reaction: pH 7.9 to 9.6

Bknyz horizons
Hue: 2.5Y, 10YR, or 7.5YR
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Clay loam, silty clay, clay, or silty clay loam
Clay content: 35 to 50 percent
Content of rock fragments: 0 to 20 percent pebbles
Calcium carbonate equivalent: 4 to 15 percent
Electrical conductivity: 16 to 30 mmhos/cm
Sodium adsorption ratio: 23 to 70
Gypsum: 1 to 5 percent
Reaction: pH 7.9 to 9.0

214A—Absher clay loam, wet, 0 to 2 percent slopes

Setting

Landform: Alluvial fans and stream terraces
Slope: 0 to 2 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Absher, wet and similar soils: 90 percent

Minor Components
Lardell and similar soils: 0 to 5 percent
Nobe and similar soils: 0 to 3 percent
Gerdrum and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Apparent
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 4.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Acel Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Glaciated till plain
Parent material: Glaciofluvial deposits and alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic Mollic Eutroboralfs

Typical Pedon

Acel silty clay loam, 0 to 4 percent slopes, in an area of nonirrigated cropland, 1,300 feet south and 2,600 feet east of the northwest corner of sec. 4, T. 29 N., R. 2 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; massive when dry; very hard, firm, moderately sticky, moderately plastic; common fine roots; common fine pores; few unstained sand grains; neutral; clear smooth boundary.

E—5 to 8 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, moderately sticky, moderately plastic; common fine roots; common fine pores; common unstained silt and sand drains; neutral; clear smooth boundary.

Bt1—8 to 11 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; strong fine and medium prismatic structure parting to strong fine subangular blocky; hard, friable, very sticky, moderately plastic; common fine roots; common very fine pores; common distinct clay films on faces of peds; slightly alkaline; clear smooth boundary.

Bt2—11 to 24 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, very sticky, moderately plastic; common fine roots; common very fine pores; common distinct clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bk1—24 to 35 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, friable, moderately sticky, moderately plastic; few very fine roots; common very fine pores; few fine soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—35 to 50 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, friable, moderately sticky, moderately plastic; few very fine roots; few very fine pores; common fine soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bky—50 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; massive; very hard, friable, moderately sticky, moderately plastic; common fine and medium soft masses of lime; common fine threads of gypsum crystals; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Bk horizon: 15 to 25 inches

Ap horizon
Hue: 2.5Y or 10YR
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 5 percent pebbles
Reaction: pH 6.6 to 7.8

E horizon
Hue: 2.5Y or 10YR
Clay content: 27 to 35 percent

Content of rock fragments: 0 to 5 percent pebbles
Reaction: pH 6.6 to 7.8

Bt horizons
Hue: 2.5Y or 10YR
Value: 4 or 5 dry; 3 or 4 moist
Chroma: 2 or 3
Texture: Silty clay or clay
Clay content: 40 to 55 percent
Content of rock fragments: 0 to 5 percent pebbles
Reaction: pH 6.6 to 7.8

Bk and Bky horizons
Hue: 2.5Y or 10YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay loam, silty clay loam, or silty clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 9.0

31B—Acel silty clay loam, 0 to 4 percent slopes

Setting

Landform: Till plains
Slope: 0 to 4 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Acel and similar soils: 85 percent

Minor Components
Scobey and similar soils: 0 to 7 percent
Ethridge and similar soils: 0 to 5 percent
Kobase and similar soils: 0 to 2 percent
Nishon and similar soils: 0 to 1 percent

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Adel Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and mountain slopes
Parent material: Alluvium
Slope range: 0 to 60 percent
Mean annual precipitation: 18 to 24 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 60 to 90 days

Taxonomic Class: Fine-loamy, mixed Pachic Cryoborolls

Typical Pedon

Adel stony loam, in an area of Adel-Burnette-Bynum complex, 4 to 35 percent slopes, in an area of rangeland, 500 feet south and 60 feet east of the northwest corner of sec. 16, T. 25 N., R. 8 W.

A1—0 to 8 inches; very dark grayish brown (10YR 3/2) stony loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; soft, friable, slightly sticky, slightly plastic; many very fine and fine and common medium roots; many fine pores; 10 percent pebbles and 5 percent stones; neutral; gradual smooth boundary.

A2—8 to 20 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine and common medium roots; common fine and medium tubular pores; neutral; gradual smooth boundary.

A3—20 to 32 inches; dark grayish brown (10YR 4/2) loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, moderately sticky, slightly plastic; common very fine and fine roots; many fine and medium irregular tubular pores; neutral; gradual wavy boundary.

Bw—32 to 50 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; common fine irregular tubular pores; neutral; gradual wavy boundary.

C—50 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; massive; slightly hard, friable, moderately sticky, moderately plastic; few very fine roots; strongly effervescent; slightly alkaline.

Range in Characteristics

Soil temperature: 37 to 46 degrees F; summer temperatures of 52 to 59 degrees F
Thickness of the mollic epipedon: 16 to 60 inches

A1 horizon
Hue: 2.5Y or 10YR
Value: 2 to 4 dry; 2 or 3 moist
Chroma: 1 or 2
Clay content: 15 to 27 percent
Content of rock fragments: 0 to 35 percent—0 to 5 percent stones and cobbles; 0 to 30 percent pebbles
Reaction: pH 6.1 to 7.3

A2 horizon
Hue: 2.5Y or 10YR
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 to 3
Texture: Loam or clay loam
Clay content: 20 to 30 percent
Content of rock fragments: 0 to 35 percent—0 to 5 percent stones and cobbles; 0 to 30 percent pebbles
Reaction: pH 6.1 to 7.8

A3 horizon
Hue: 2.5Y or 10YR
Value: 3 to 5 dry; 2 to 4 moist
Chroma: 1 to 3
Texture: Loam or clay loam
Clay content: 20 to 30 percent
Content of rock fragments: 0 to 35 percent—0 to 5 percent stones and cobbles; 0 to 30 percent pebbles
Reaction: pH 6.1 to 7.3

Bw horizon
Hue: 2.5Y or 10YR
Value: 4 or 5 dry; 2 to 4 moist
Chroma: 1 to 3
Texture: Loam, clay loam, or silty clay loam
Clay content: 18 to 30 percent
Content of rock fragments: 0 to 35 percent—0 to 10 percent stones and cobbles; 0 to 25 percent pebbles
Reaction: pH 6.1 to 7.8

C horizon
Hue: 2.5Y or 10YR
Value: 4 to 6 dry; 3 to 5 moist
Texture: Loam, clay loam, or silty clay loam
Clay content: 18 to 30 percent
Content of rock fragments: 0 to 35 percent—0 to 10 percent stones and cobbles; 0 to 25 percent pebbles
Reaction: pH 6.1 to 7.8

197E—Adel-Doby-Hanson complex, 8 to 35 percent slopes

Setting

Landform:
- Adel—Hills
- Doby—Hills
- Hanson—Hills

Position on landform:
- Adel—Backslopes and footslopes
- Doby—Backslopes
- Hanson—Shoulders and summits

Slope:
- Adel—8 to 35 percent
- Doby—8 to 35 percent
- Hanson—15 to 35 percent

Elevation: 4,600 to 5,600 feet
Mean annual precipitation: 18 to 20 inches
Frost-free period: 60 to 90 days

Composition

Major Components
Adel and similar soils: 30 percent
Doby and similar soils: 30 percent
Hanson and similar soils: 25 percent

Minor Components
Raynesford and similar soils: 0 to 6 percent
Bynum and similar soils: 0 to 3 percent
Shedhorn and similar soils: 0 to 3 percent
Sebud and similar soils: 0 to 2 percent
Teton and similar soils: 0 to 1 percent

Major Component Description

Adel
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained

Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.4 inches

Doby
Surface layer texture: Clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 2.4 inches

Hanson
Surface layer texture: Very cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 4.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

198C—Adel-Gallatin-Shedhorn complex, 0 to 8 percent slopes

Setting

Landform:
- Adel—Mountains
- Gallatin—Mountains
- Shedhorn—Mountains

Position on landform:
- Adel—Footslopes and toeslopes
- Gallatin—Toeslopes
- Shedhorn—Footslopes and toeslopes

Slope:
- Adel—0 to 8 percent
- Gallatin—0 to 8 percent
- Shedhorn—0 to 8 percent

Elevation: 4,600 to 5,600 feet
Mean annual precipitation: 19 to 22 inches
Frost-free period: 60 to 90 days

Composition

Major Components
Adel and similar soils: 35 percent
Gallatin and similar soils: 25 percent
Shedhorn and similar soils: 25 percent

Minor Components
Sebud and similar soils: 0 to 7 percent
Burnette and similar soils: 0 to 6 percent
Gallatin and similar soils: 0 to 2 percent

Major Component Description

Adel
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 9.4 inches

Gallatin
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Forest land
Flooding: Rare
Water table: Apparent
Available water capacity: Mainly 8.0 inches

Shedhorn
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium
Native plant cover type: Forest land
Flooding: None
Water table: Apparent
Available water capacity: Mainly 7.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

294E—Adel-Burnette-Bynum complex, 4 to 35 percent slopes

Setting

Landform:
- Adel—Mountains
- Burnette—Mountains
- Bynum—Mountains

Position on landform:
- Adel—Backslopes and footslopes
- Burnette—Backslopes and footslopes
- Bynum—Shoulders and summits

Slope:
- Adel—4 to 35 percent
- Burnette—4 to 25 percent
- Bynum—4 to 35 percent

Elevation: 4,600 to 6,000 feet
Mean annual precipitation: 18 to 21 inches
Frost-free period: 60 to 90 days

Composition

Major Components
Adel and similar soils: 35 percent
Burnette and similar soils: 30 percent
Bynum and similar soils: 20 percent

Minor Components
Sebud and similar soils: 0 to 6 percent
Teton and similar soils: 0 to 4 percent
Tibson and similar soils: 0 to 4 percent
Gallatin and similar soils: 0 to 1 percent

Major Component Description

Adel
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.3 inches

Burnette
Surface layer texture: Stony clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.5 inches

Bynum
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Interbedded sandstone and shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

394E—Adel-Burnette-Sebud complex, 4 to 35 percent slopes

Setting

Landform:
- Adel—Mountains
- Burnette—Mountains
- Sebud—Mountains

Position on landform:
- Adel—Backslopes and footslopes
- Burnette—Backslopes and footslopes
- Sebud—Backslopes and shoulders

Slope:
- Adel—4 to 35 percent
- Burnette—4 to 35 percent
- Sebud—4 to 35 percent

Elevation: 4,600 to 5,600 feet
Mean annual precipitation: 19 to 24 inches
Frost-free period: 60 to 90 days

Composition

Major Components
Adel and similar soils: 30 percent
Burnette and similar soils: 30 percent
Sebud and similar soils: 25 percent

Minor Components
Tibson and similar soils: 0 to 6 percent
Bynum and similar soils: 0 to 4 percent
Teton and similar soils: 0 to 4 percent
Gallatin and similar soils: 0 to 1 percent

Major Component Description

Adel
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium

Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 9.4 inches

Burnette
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 9.7 inches

Sebud
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 3.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Amor Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and sedimentary plains
Parent material: Sedimentary beds
Slope range: 2 to 35 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed Typic Haploborolls

Typical Pedon

Amor loam, in an area of Amor-Cabba loams, 2 to 15 percent slopes, in an area of native hayland, 2,000 feet south and 100 feet west of the northeast corner of sec. 19, T. 27 N., R. 8 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; many fine roots; many fine irregular pores; neutral; clear smooth boundary.

Bw—6 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; many fine roots; many fine irregular pores; neutral; clear smooth boundary.

Bk1—14 to 17 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, moderately sticky, slightly plastic; common very fine and fine roots; many very fine tubular pores; few fine threads of segregated lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—17 to 25 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, moderately sticky, slightly plastic; few very fine and fine roots; common fine tubular pores; few fine threads of segregated lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

BC—25 to 32 inches; light brownish gray (2.5Y 6/2) loam with 40 percent soft fine shale chips, grayish brown (2.5Y 5/2) moist; weak fine subangular blocky structure; hard, friable, nonsticky, nonplastic; few fine roots; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cr—32 inches; calcareous semiconsolidated loamy sedimentary beds.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Thickness of the mollic epipedon: 7 to 14 inches

A horizon
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 15 to 27 percent
Reaction: pH 6.6 to 7.3

Bw horizon
Hue: 2.5Y or 10YR
Value: 4 to 7 dry; 3 to 6 moist
Chroma: 2 to 4
Texture: Loam, silt loam, or clay loam
Clay content: 18 to 30 percent
Reaction: pH 6.6 to 8.4

Bk horizons
Hue: 2.5Y or 10YR
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, silt loam, fine sandy loam, or clay loam
Clay content: 18 to 30 percent
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

BC horizon
Value: 6 or 7 dry; 4 to 6 moist
Clay content: 20 to 27 percent
Reaction: pH 7.4 to 8.4

174D—Amor-Cabba loams, 2 to 15 percent slopes

Setting

Landform:
- Amor—Hills
- Cabba—Hills

Position on landform:
- Amor—Footslopes and toeslopes
- Cabba—Shoulders

Slope:
- Amor—2 to 15 percent
- Cabba—2 to 15 percent

Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Amor and similar soils: 45 percent
Cabba and similar soils: 40 percent

Minor Components
Roundor and similar soils: 0 to 6 percent
Shambo and similar soils: 0 to 6 percent
Winifred and similar soils: 0 to 2 percent
Linwell and similar soils: 0 to 1 percent

Major Component Description

Amor
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.4 inches

Cabba
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Arrod Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Relict stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 12 to 14 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Loamy-skeletal, carbonatic, shallow Petrocalcic Calciborolls

Typical Pedon

Arrod gravelly loam, in an area of Niart-Crago-Arrod gravelly loams, 0 to 4 percent slopes, in an area of rangeland, 150 feet north and 2,700 feet east of the southwest corner of sec. 22, T. 22 N., R. 2 W. (Teton County, Montana)

A—0 to 7 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; many fine roots; many fine irregular pores; 15 percent pebbles with lime coats on undersides and 5 percent cobbles; strongly effervescent; mildly alkaline; clear irregular boundary.

Bk—7 to 15 inches; pale brown (10YR 6/3) very gravelly loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; common fine irregular pores; 35 percent pebbles with thick lime crusts on undersides and

10 percent cobbles; violently effervescent; moderately alkaline; abrupt wavy boundary.

2Bkm—15 to 25 inches; light gray (10YR 7/2) calcium carbonate cemented gravel and cobbles; extremely hard; violently effervescent; abrupt wavy boundary.

3Bk—25 to 60 inches; very pale brown (10YR 7/3) extremely gravelly loamy sand, brown (10YR 5/3) moist; single grain; loose, nonsticky, nonplastic; 60 percent pebbles with thick lime crusts on undersides and 10 percent cobbles; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 44 to 47 degrees F
Thickness of the mollic epipedon: 7 to 10 inches
Depth to the petrocalcic horizon: 10 to 20 inches

A horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 35 percent—0 to 20 percent stones and cobbles; 0 to 15 percent pebbles
Reaction: pH 7.4 to 7.8

Bk horizon
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 7 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 35 to 90 percent—0 to 15 percent stones and cobbles; 35 to 75 percent pebbles
Calcium carbonate equivalent: 30 to 60 percent
Reaction: pH 7.4 to 8.4

2Bkm horizon
Hard massive layer of calcium carbonate cemented rock fragments 4- to 12-inches thick
Reaction: pH 7.4 to 8.4

3Bk horizon
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 to 4
Texture: Sand, loamy sand, or sandy loam
Clay content: 0 to 10 percent
Content of rock fragments: 60 to 90 percent—0 to 20 percent stones and cobbles; 60 to 75 percent pebbles
Calcium carbonate equivalent: 25 to 50 percent
Reaction: pH 7.4 to 8.4

Assinniboine Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Stream terraces
Parent material: Alluvium
Slope range: 0 to 8 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 115 to 125 days

Taxonomic Class: Fine-loamy, mixed Aridic Argiborolls

Typical Pedon

Assinniboine fine sandy loam, 0 to 8 percent slopes, in an area of nonirrigated cropland, 2,000 feet north and 100 feet west of the southeast corner of sec. 36, T. 28 N., R. 1 E.

Ap—0 to 6 inches; brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky, nonplastic; common fine and medium roots; many medium vesicular pores; neutral; abrupt smooth boundary.

Bt—6 to 14 inches; dark yellowish brown (10YR 4/4) sandy clay loam, dark brown (10YR 3/3) moist; strong coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky, slightly plastic; common fine roots; many very fine and fine tubular pores; few distinct clay films in bridges between sand grains; slightly alkaline; gradual wavy boundary.

Bk1—14 to 21 inches; pale brown (10YR 6/3) fine sandy loam, grayish brown (10YR 5/2) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky, slightly plastic; common fine roots; many fine and medium tubular pores; few fine soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—21 to 42 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky, nonplastic; common very fine and fine roots in upper part grading to few fine roots in lower part; many fine tubular pores; few fine soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—42 to 60 inches; grayish brown (2.5Y 5/2) sandy loam, dark grayish brown (2.5Y 4/2) moist;

massive; hard, firm, slightly sticky, moderately plastic; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 43 to 47 degrees F
Thickness of the mollic epipedon: 7 to 16 inches; may include all or part of the Bt horizons.
Depth to the Bk horizon: 10 to 25 inches
Other features: Some pedons have a Btk horizon.

Ap horizon
Hue: 10YR or 2.5Y
Chroma: 2 or 3
Content of rock fragments: 0 to 25 percent pebbles
Clay content: 5 to 15 percent
Reaction: pH 6.1 to 7.8

Bt horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 to 4
Texture: Sandy clay loam or fine sandy loam
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.6 to 7.8

Bk and C horizons
Hue: 2.5Y or 10YR
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Sandy loam, fine sandy loam, or sandy clay loam
Clay content: 0 to 20 percent
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

132C—Assinniboine fine sandy loam, 0 to 8 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 8 percent
Elevation: 3,000 to 3,600 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 115 to 125 days

Composition

Major Components
Assinniboine and similar soils: 85 percent

Minor Components
Chinook and similar soils: 0 to 9 percent
Joplin and similar soils: 0 to 3 percent
Kevin and similar soils: 0 to 3 percent

Major Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Attewan Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate in the upper 20 to 40 inches; rapid below this depth
Landform: Stream terraces
Parent material: Alluvium
Slope range: 0 to 8 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed Aridic Argiborolls

Typical Pedon

Attewan loam, in an area of Attewan-Wabek complex, 0 to 8 percent slopes, in an area of nonirrigated cropland, 500 feet south and 1,320 feet east of the northwest corner of sec. 35, T. 29 N., R. 2 W. (Pondera County, Montana)

Ap—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many fine roots; neutral; clear wavy boundary.
Bt—5 to 11 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium

subangular blocky; hard, friable, slightly sticky, moderately plastic; many very fine and fine roots; many very fine tubular pores; few distinct clay films; dark brown (10YR 4/3) coats on faces of peds; neutral; clear wavy boundary.

Bk1—11 to 14 inches; light grayish brown (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to weak medium subangular blocky; hard, friable, moderately sticky, slightly plastic; many very fine and fine roots; many very fine and fine pores; few fine soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—14 to 21 inches; light gray (2.5Y 7/2) clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure; hard, friable, moderately sticky, slightly plastic; common very fine and fine roots; common very fine and fine pores; common fine soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

2Bk3—21 to 28 inches; light gray (2.5Y 7/2) very gravelly sandy loam, grayish brown (2.5Y 5/2) moist; single grain; slightly hard, very friable, slightly sticky, nonplastic; few very fine roots; 50 percent pebbles with lime coats on surfaces and crusts on undersides; violently effervescent; moderately alkaline; gradual wavy boundary.

2C—28 to 60 inches; pale brown (10YR 6/3) extremely gravelly loamy sand, dark brown (10YR 4/3) moist; single grain; loose, nonsticky, nonplastic; 60 percent pebbles with lime crusts on undersides; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Thickness of the mollic epipedon: 7 to 12 inches; may include all or part of the argillic horizon.
Depth to the Bk horizon: 10 to 21 inches
Depth to the 2C horizon: 20 to 40 inches

Ap horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Texture: Loam or fine sandy loam
Clay content: 10 to 20 percent
Content of rock fragments: 0 to 50 percent—0 to 20 percent greater than 3-inch stones and cobbles; 0 to 30 percent less than 3-inch pebbles
Reaction: pH 6.1 to 7.3

Bt horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 2 or 3
Texture: Clay loam, sandy clay loam, or loam
Clay content: 20 to 35 percent
Content of rock fragments: 0 to 25 percent—0 to 5 percent greater than 3-inch stones and cobbles; 0 to 20 percent less than 3-inch pebbles
Reaction: pH 6.6 to 7.8

Bk horizons
Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4 or 6
Texture: Loam, clay loam, silt loam, sandy clay loam, or sandy loam
Clay content: 15 to 30 percent
Content of rock fragments: 0 to 30 percent—0 to 5 percent stones and cobbles; 0 to 25 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

2Bk3 and 2C horizons
Hue: 2.5Y or 10YR
Value: 4 to 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Sandy loam, loamy sand, sand, loamy coarse sand, or coarse sand
Clay content: 0 to 10 percent
Content of rock fragments: 35 to 75 percent—0 to 15 percent stones and cobbles; 35 to 60 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

116B—Attewan fine sandy loam, 0 to 4 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 4 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Attewan and similar soils: 85 percent

Minor Components
Evanston and similar soils: 0 to 6 percent
Wabek and similar soils: 0 to 5 percent
Assinniboine and similar soils: 0 to 2 percent
Chinook and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

216C—Attewan-Wabek complex, 0 to 8 percent slopes

Setting

Landform:
- Attewan—Stream terraces
- Wabek—Stream terraces

Position on landform:
- Attewan—Footslopes and toeslopes
- Wabek—Shoulders and summits

Slope:
- Attewan—0 to 8 percent
- Wabek—0 to 8 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Attewan and similar soils: 50 percent
Wabek and similar soils: 35 percent

Minor Components
Twilight and similar soils: 0 to 7 percent
Assinniboine and similar soils: 0 to 2 percent
Chinook and similar soils: 0 to 2 percent
Evanston and similar soils: 0 to 2 percent
Yetull and similar soils: 0 to 2 percent

Major Component Description

Attewan
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Wabek
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Babb Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountain slopes
Parent material: Alpine till
Slope range: 4 to 45 percent
Mean annual precipitation: 18 to 22 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 60 to 90 days

Taxonomic Class: Fine-loamy, mixed Typic Cryoborolls

Typical Pedon

Babb cobbly loam, in an area of Babb-Tibson-Adel complex, 4 to 35 percent slopes, in an area of rangeland, 1,050 feet north and 1,740 feet west of the southeast corner of sec. 24, T. 27 N., R. 9 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; soft, very

friable, slightly sticky, slightly plastic; many fine and common medium roots; 15 percent cobbles, 10 percent pebbles, and 5 percent stones; neutral; clear smooth boundary.

Bw1—6 to 12 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and common medium roots; 20 percent pebbles, 10 percent cobbles, and 5 percent stones; slightly effervescent; slightly alkaline; gradual smooth boundary.

Bw2—12 to 22 inches; light brownish gray (10YR 6/2) gravelly clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, moderately sticky, moderately plastic; many fine and common medium roots; 15 percent pebbles and 5 percent cobbles; slightly effervescent; moderately alkaline; gradual wavy boundary.

Bk1—22 to 40 inches; light gray (10YR 7/2) gravelly clay loam, grayish brown (10YR 5/2) moist; moderate medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine and fine roots; 15 percent pebbles and 5 percent cobbles; common medium soft masses of lime; violently effervescent; moderately alkaline; diffuse wavy boundary.

Bk2—40 to 60 inches; light gray (10YR 7/2) gravelly clay loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; few very fine and fine roots; 20 percent pebbles and 10 percent cobbles; common medium soft masses of lime; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 38 to 42 degrees F
Thickness of the mollic epipedon: 10 to 16 inches; may include the Bw1 horizon.
Depth to the Bk horizon: 16 to 30 inches

A horizon
Hue: 10YR
Value: 2 to 4 dry; 1 to 3 moist
Chroma: 1 or 2
Clay content: 18 to 27 percent
Content of rock fragments: 15 to 35 percent—10 to 20 percent stones and cobbles; 5 to 15 percent pebbles
Reaction: pH 6.6 to 7.8

Bw horizons
Hue: 2.5Y, 10YR, or 7.5YR
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 18 to 30 percent
Content of rock fragments: 15 to 35 percent—5 to 10 percent cobbles; 10 to 25 percent pebbles
Reaction: pH 6.6 to 7.8

Bk horizons
Hue: 2.5Y, 10YR, or 7.5YR
Value: 7 or 8 dry; 5 or 6 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 18 to 30 percent
Content of rock fragments: 15 to 35 percent—5 to 10 percent cobbles; 10 to 25 percent pebbles
Calcium carbonate equivalent: 20 to 40 percent
Reaction: pH 7.9 to 8.4

296E—Babb-Tibson-Adel complex, 4 to 35 percent slopes

Setting

Landform:
- Babb—Mountains
- Tibson—Mountains
- Adel—Mountains

Position on landform:
- Babb—Backslopes and footslopes
- Tibson—Shoulders and summits
- Adel—Footslopes

Slope:
- Babb—4 to 35 percent
- Tibson—4 to 35 percent
- Adel—4 to 35 percent

Elevation: 4,600 to 6,000 feet
Mean annual precipitation: 18 to 22 inches
Frost-free period: 60 to 90 days

Composition

Major Components
Babb and similar soils: 35 percent
Tibson and similar soils: 30 percent
Adel and similar soils: 20 percent

Minor Components
Burnette and similar soils: 0 to 6 percent
Cheadle and similar soils: 0 to 3 percent
Gallatin and similar soils: 0 to 2 percent
Sebud and similar soils: 0 to 2 percent
Teton and similar soils: 0 to 2 percent

Major Component Description

Babb
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.7 inches

Tibson
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.2 inches

Adel
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

590E—Babb-Fifer-Cheadle complex, 8 to 45 percent slopes

Setting

Landform:
- Babb—Mountains
- Fifer—Mountains
- Cheadle—Mountains

Position on landform:
- Babb—Backslopes and footslopes
- Fifer—Shoulders and summits
- Cheadle—Shoulders and summits

Slope:
- Babb—8 to 45 percent
- Fifer—8 to 45 percent
- Cheadle—8 to 45 percent

Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 18 to 20 inches
Frost-free period: 60 to 90 days

Composition

Major Components
Babb and similar soils: 30 percent
Fifer and similar soils: 30 percent
Cheadle and similar soils: 25 percent

Minor Components
Adel and similar soils: 0 to 5 percent
Teton and similar soils: 0 to 5 percent
Sebud and similar soils: 0 to 3 percent
Starley and similar soils: 0 to 2 percent

Major Component Description

Babb
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 9.0 inches

Fifer
Surface layer texture: Clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Interbedded shale and siltstone residuum
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 2.2 inches

Cheadle
Surface layer texture: Stony loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 1.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Bascovy Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Very slow
Landform: Hills and sedimentary plains
Parent material: Residuum from semiconsolidated shale
Slope range: 2 to 45 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic, frigid Leptic Udic Haplusterts

Typical Pedon

Bascovy silty clay, in an area of Bascovy-Neldore complex, 2 to 8 percent slopes, in an area of rangeland, 1,700 feet north and 1,900 feet west of the southeast corner of sec. 34, T. 23 N., R. 1 W.

A—0 to 5 inches; gray (10YR 5/1) silty clay, dark gray (10YR 4/1) moist; with very dark grayish brown (10YR 3/2) coats on faces of peds; moderate medium subangular blocky structure parting to moderate medium granular; hard, friable, moderately sticky, moderately plastic; common fine roots; few fine pores; slightly alkaline; clear smooth boundary.

Bw—5 to 11 inches; gray (10YR 5/1) silty clay, dark gray (10YR 4/1) moist; moderate medium prismatic structure parting to strong medium subangular blocky; hard, firm, moderately sticky, moderately plastic; common fine roots; few fine pores; slightly alkaline; gradual smooth boundary.

Bssy—11 to 18 inches; gray (10YR 5/1) silty clay, dark gray (10YR 4/1) moist; massive; very hard, very firm, very sticky, moderately plastic; common very fine roots; few fine pores; common vertical cracks and pressure faces; few fine threadlike seams of gypsum; 10 percent soft shale fragments; slightly alkaline; gradual wavy boundary.

C—18 to 25 inches; gray (10YR 5/1) silty clay, dark gray (10YR 4/1) moist; massive; very hard, firm, very sticky, moderately plastic; common very fine roots in cracks and between plates of soft shale; 30 percent soft shale and 10 percent hard shale fragments; slightly alkaline; gradual wavy boundary.

Cr—25 to 60 inches; gray (10YR 5/1) and grayish brown (2.5Y 5/2) semiconsolidated shale; strongly acid.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Cr horizon: 20 to 40 inches
Other features: The chroma of 1 is lithochromic.

A horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 3 to 5 moist
Chroma: 1 to 3
Clay content: 40 to 60 percent
Electrical conductivity: 2 to 4 mmhos/cm
Reaction: pH 6.6 to 8.4

Bw horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 1 to 3
Texture: Clay or silty clay
Clay content: 40 to 60 percent
Electrical conductivity: 2 to 4 mmhos/cm
Reaction: pH 6.1 to 8.4

Bssy horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 1 to 3
Texture: Clay or silty clay
Clay content: 40 to 60 percent
Gypsum: 1 to 5 percent
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 6.1 to 8.4

C horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 1 or 2
Texture: Clay or silty clay
Clay content: 40 to 60 percent
Electrical conductivity: 0 to 8 mmhos/cm
Reaction: pH 5.1 to 8.4

169C—Bascovy-Neldore complex, 2 to 8 percent slopes

Setting

Landform:
- Bascovy—Sedimentary plains
- Neldore—Sedimentary plains

Position on landform:
- Bascovy—Footslopes and toeslopes
- Neldore—Backslopes and shoulders

Slope:
- Bascovy—2 to 8 percent
- Neldore—2 to 8 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Bascovy and similar soils: 50 percent
Neldore and similar soils: 35 percent

Minor Components
Tanna and similar soils: 0 to 5 percent
Pylon and similar soils: 0 to 4 percent
Abor and similar soils: 0 to 3 percent
Marvan and similar soils: 0 to 3 percent

Major Component Description

Bascovy
Surface layer texture: Silty clay
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 3.7 inches

Neldore
Surface layer texture: Clay
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Beanlake Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Moraines and hills
Parent material: Alpine till
Slope range: 0 to 35 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed Typic Calciborolls

Typical Pedon

Beanlake cobbly loam, in an area of Beanlake-Winspect cobbly loams, 2 to 15 percent slopes, in an area of rangeland, 700 feet north and 1,900 feet east of the southwest corner of sec. 16, T. 22 N., R. 7 W.

A—0 to 6 inches; dark brown (10YR 4/3) cobbly loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure parting to moderate medium granular; slightly hard, very friable, slightly sticky, slightly plastic; many fine and few medium roots; common fine irregular pores; 10 percent cobbles, 5 percent pebbles, and 2 percent stones; moderately effervescent; slightly alkaline; clear smooth boundary.

Bk—6 to 9 inches; brown (10YR 5/3) cobbly loam, dark brown (10YR 4/3) moist; moderate fine prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; common fine irregular pores; 15 percent cobbles, 5 percent pebbles, and 2 percent stones; lime coats on undersides of rock fragments; few fine soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bky1—9 to 15 inches; light brownish gray (10YR 6/2) loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; common fine and many very fine roots; common very fine and fine pores; 10 percent pebbles and few cobbles; lime coats on undersides of rock fragments; common medium soft masses of lime and gypsum;

violently effervescent; moderately alkaline; clear wavy boundary.

Bky2—15 to 28 inches; light brownish gray (10YR 6/2) cobbly loam, grayish brown (10YR 5/2) moist; strong coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky, slightly plastic; common very fine roots; few very fine and fine pores; 10 percent cobbles and 10 percent pebbles; many fine soft masses of lime and gypsum; violently effervescent; moderately alkaline; gradual wavy boundary.

Bky3—28 to 60 inches; light brownish gray (10YR 6/2) cobbly loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure in the upper part grading to massive in the lower part; hard, firm, slightly sticky, slightly plastic; few very fine roots; few very fine pores; 10 percent cobbles and 10 percent pebbles; few fine soft masses of lime and gypsum; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 8 inches

A horizon
Hue: 10YR
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 1 to 3
Clay content: 18 to 25 percent
Content of rock fragments: 10 to 30 percent—0 to 15 percent stones and cobbles; 0 to 15 percent pebbles
Reaction: pH 7.4 to 8.4

Bk horizon
Hue: 10YR
Value: 5 to 8 dry; 3 to 6 moist
Chroma: 2 or 3
Clay content: 18 to 35 percent
Calcium carbonate equivalent: 15 to 25 percent
Content of rock fragments: 10 to 35 percent—0 to 20 percent stones and cobbles; 5 to 15 percent pebbles
Reaction: pH 7.9 to 8.4

Bky1 horizon
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 5 or 6 moist
Chroma: 2 or 3
Clay content: 18 to 25 percent
Electrical conductivity: 0 to 4 mmhos/cm
Calcium carbonate equivalent: 15 to 25 percent
Gypsum content: 1 to 3 percent
Content of rock fragments: 10 to 35 percent—0 to 20 percent stones and cobbles; 5 to 15 percent pebbles
Reaction: pH 7.9 to 9.0

Bky2 and Bky3 horizons
Hue: 10YR or 2.5Y
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 18 to 25 percent
Electrical conductivity: 0 to 4 mmhos/cm
Gypsum content: 1 to 3 percent
Calcium carbonate equivalent: 8 to 15 percent
Content of rock fragments: 15 to 40 percent—0 to 5 percent stones; 10 to 20 percent cobbles; 5 to 15 percent pebbles
Moist bulk density: More than 1.6 g/cm^3
Reaction: pH 7.9 to 9.0

327C—Beanlake-Winspect cobbly loams, 2 to 15 percent slopes

Setting

Landform:
- Beanlake—Moraines
- Winspect—Moraines

Position on landform:
- Beanlake—Footslopes
- Winspect—Shoulders

Slope:
- Beanlake—2 to 15 percent
- Winspect—2 to 15 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Beanlake and similar soils: 45 percent
Winspect and similar soils: 40 percent

Minor Components
Manhattan and similar soils: 0 to 5 percent
Shambo and similar soils: 0 to 5 percent
Saypo and similar soils: 0 to 3 percent
Birchfield and similar soils: 0 to 1 percent
Tetonview and similar soils: 0 to 1 percent

Major Component Description

Beanlake
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained

Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

Winspect
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

427C—Beanlake-Saypo-Winspect complex, 0 to 8 percent slopes

Setting

Landform:
- Beanlake—Moraines
- Saypo—Closed depressions
- Winspect—Moraines

Position on landform:
- Beanlake—Footslopes and toeslopes
- Winspect—Shoulders

Slope:
- Beanlake—0 to 8 percent
- Saypo—0 to 4 percent
- Winspect—4 to 8 percent

Elevation: 4,000 to 4,800 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Beanlake and similar soils: 35 percent
Saypo and similar soils: 30 percent
Winspect and similar soils: 20 percent

Minor Components
Kiev and similar soils: 0 to 8 percent
Manhattan and similar soils: 0 to 5 percent
Birchfield and similar soils: 0 to 1 percent
Tetonview and similar soils: 0 to 1 percent

Major Component Description

Beanlake
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

Saypo
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Apparent
Available water capacity: Mainly 7.8 inches

Winspect
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Flooding: None
Available water capacity: Mainly 6.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

527E—Beanlake-Cabba-Castner complex, 8 to 35 percent slopes

Setting

Landform:
- Beanlake—Hills
- Cabba—Hills
- Castner—Hills

Position on landform:
- Beanlake—Backslopes and footslopes
- Cabba—Shoulders and summits
- Castner—Shoulders and summits

Slope:
- Beanlake—8 to 35 percent
- Cabba—8 to 35 percent
- Castner—8 to 35 percent

Elevation: 4,000 to 4,800 feet
Mean annual precipitation: 16 to 19 inches
Frost-free period: 90 to 100 days

Composition

Major Components
Beanlake and similar soils: 30 percent
Cabba and similar soils: 30 percent
Castner and similar soils: 25 percent

Minor Components
Winspect and similar soils: 0 to 10 percent
Shambo and similar soils: 0 to 5 percent

Major Component Description

Beanlake
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

Cabba
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

Castner
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

727C—Beanlake-Manhattan-Winspect complex, 2 to 15 percent slopes

Setting

Landform:
- Beanlake—Hills
- Manhattan—Hills
- Winspect—Hills

Position on landform:
- Beanlake—Footslopes
- Manhattan—Backslopes and footslopes
- Winspect—Shoulders

Slope:
- Beanlake—2 to 15 percent
- Manhattan—2 to 15 percent
- Winspect—2 to 15 percent

Elevation: 4,000 to 4,800 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Beanlake and similar soils: 30 percent
Manhattan and similar soils: 30 percent
Winspect and similar soils: 25 percent

Minor Components
Fairfield and similar soils: 0 to 8 percent
Saypo and similar soils: 0 to 5 percent
Birchfield and similar soils: 0 to 1 percent
Tetonview and similar soils: 0 to 1 percent

Major Component Description

Beanlake
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

Manhattan
Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or eolian material
Native plant cover type: Rangeland

Flooding: None
Available water capacity: Mainly 6.6 inches

Winspect
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Binna Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to 22 inches; moderately rapid below this depth
Landform: Relict stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed Aridic Calciborolls

Typical Pedon

Binna loam, in an area of Binna-Scravo complex, 0 to 4 percent slopes, in an area of nonirrigated cropland, 600 feet north and 2,600 feet east of the southwest corner of sec. 35, T. 30 N., R. 7 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky, nonplastic; many fine roots; many fine irregular pores; 5 percent pebbles; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk1—6 to 11 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, very friable, slightly sticky, nonplastic; many very fine and fine roots; many fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—11 to 18 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; many fine pores; 5 percent pebbles with lime coats on undersides; common medium soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk3—18 to 22 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky, slightly plastic; few fine roots; common very fine and fine pores; 10 percent pebbles with lime coats on undersides; common fine soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

2C1—22 to 26 inches; light brownish gray (10YR 6/2) extremely gravelly loamy sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky, nonplastic; few fine roots; 65 percent pebbles; strongly effervescent; moderately alkaline; clear wavy boundary.

2C2—26 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly loamy sand, grayish brown (10YR 5/2) moist; single grain; nonsticky, nonplastic; 65 percent pebbles and 10 percent cobbles; strongly effervescent; slightly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 10 inches
Depth to the sandy-skeletal horizon: 20 to 40 inches

Ap horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry (Value 5 is dry when mixed to 7 inches.)
Chroma: 2 or 3
Clay content: 15 to 27 percent
Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 10 percent pebbles
Reaction: pH 7.4 to 8.4

Bk1 and Bk2 horizons
Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 or 3

Clay content: 18 to 27 percent
Content of rock fragments: 0 to 30 percent—0 to 10 percent cobbles; 0 to 20 percent pebbles
Calcium carbonate equivalent: 15 to 30 percent
Reaction: pH 7.9 to 9.0

Bk3 horizon
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 5 or 6 moist
Chroma: 2 or 3
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 30 percent—0 to 10 percent cobbles; 0 to 20 percent pebbles
Calcium carbonate equivalent: 10 to 30 percent
Reaction: pH 7.9 to 9.0

2C horizons
Hue: 10YR or 2.5Y
Value: 6 or 7 dry; 5 or 6 moist
Chroma: 2 or 3
Texture: Sand or loamy sand
Clay content: 0 to 10 percent
Content of rock fragments: 35 to 80 percent—5 to 15 percent cobbles; 30 to 65 percent pebbles
Calcium carbonate equivalent: 5 to 20 percent
Reaction: pH 7.4 to 9.0

118B—Binna-Scravo complex, 0 to 4 percent slopes

Setting

Landform:
- Binna—Relict stream terraces
- Scravo—Relict stream terraces

Slope:
- Binna—0 to 4 percent
- Scravo—0 to 4 percent

Elevation: 3,500 to 3,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Binna and similar soils: 50 percent
Scravo and similar soils: 35 percent

Minor Components
Niart and similar soils: 0 to 8 percent
Crago and similar soils: 0 to 7 percent

Major Component Description

Binna
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.5 inches

Scravo
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Birchfield Series

Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Permeability: Moderately slow
Landform: Stream terraces
Parent material: Alluvium
Slope range: 0 to 2 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy-skeletal, frigid Typic Calciaquolls

Typical Pedon

Birchfield mucky peat, in an area of Winginaw-Birchfield mucky peats, 0 to 2 percent slopes, in an area of rangeland, 2,300 feet south and 2,300 feet west of the northeast corner of sec. 28, T. 25 N., R. 7 W.

(Colors are for moist soil unless otherwise noted.)

Oi—14 to 6 inches; very dark brown (10YR 2/2) unrubbed and very dark brown (10YR 2/2) rubbed and pressed fibric material that textures to mucky peat; 80 percent fiber—50 percent rubbed; massive; nonsticky, nonplastic; 40 percent lycopodium mosses and 50 percent herbaceous and woody species; 10 percent

mineral soil; slightly alkaline; gradual wavy boundary.

Oe—6 inches to 0; black (10YR 2/1) unrubbed and black (10YR 2/1) rubbed and pressed hemic material that textures to peaty muck; 40 percent fiber—30 percent rubbed; 25 percent mineral soil; weak very fine granular structure; nonsticky, nonplastic; slightly alkaline; clear smooth boundary.

Akg—0 to 6 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; common medium distinct yellowish brown (10YR 5/4) redox concentrations; weak fine granular structure; slightly hard, friable, moderately sticky, slightly plastic; common fine roots; few fine threadlike seams of lime; slightly effervescent; slightly alkaline; clear wavy boundary.

Bkg1—6 to 11 inches; very dark grayish brown (10YR 3/2) gravelly clay loam, grayish brown (10YR 5/2) dry; common medium distinct yellowish brown (10YR 5/4 and 10YR 5/6) redox concentrations; massive; hard, friable, moderately sticky, moderately plastic; few very fine roots; common fine threadlike seams of lime; 15 percent pebbles; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bkg2—11 to 23 inches; dark grayish brown (10YR 4/2) very gravelly clay loam, light brownish gray (10YR 6/2) dry; few fine distinct yellowish brown (10YR 5/4 and 10YR 5/6) redox concentrations; massive; very hard, firm, moderately sticky, moderately plastic; 40 percent pebbles and 5 percent cobbles; common medium soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bkg3—23 to 60 inches; grayish brown (10YR 5/2) extremely gravelly loam, light gray (10YR 7/2) dry; few fine distinct yellowish brown (10YR 5/4) redox concentrations; massive; very hard, firm, moderately sticky, slightly plastic; 65 percent pebbles and 10 percent cobbles; common medium soft masses of lime; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Histic epipedon thickness: 8 to 16 inches
Thickness of the mollic epipedon: 7 to 12 inches (Colors are mollic when mixed to 7 inches if the Akg horizon is less than 7 inches.)
Depth to the seasonal high water table: 0 to 6 inches

Oi horizon
Value: 2 or 3 moist
Chroma: 1 or 2
Fiber content: 75 to 90 percent unrubbed; 45 to 70 percent rubbed
Mineral content: 5 to 20 percent
Reaction: pH 7.4 to 7.8

Oe horizon
Value: 2 or 3 moist
Chroma: 1 or 2
Fiber content: 35 to 60 percent unrubbed; 25 to 35 percent rubbed
Mineral content: 15 to 35 percent
Reaction: pH 7.4 to 7.8

Akg horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist; 3 or 4 dry
Chroma: 1 or 2
Texture: Loam or clay loam
Clay content: 20 to 30 percent
Content of rock fragments: 0 to 20 percent pebbles
Calcium carbonate equivalent: 10 to 15 percent
Reaction: pH 7.9 to 8.4

Bkg1 horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist; 4 or 5 dry
Texture: Loam or clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 5 to 35 percent pebbles
Calcium carbonate equivalent: 25 to 30 percent
Reaction: pH 7.9 to 8.4

Bkg2 horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 moist; 5 to 7 dry
Texture: Loam, clay loam, or sandy clay loam
Clay content: 20 to 30 percent
Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles; 35 to 50 percent pebbles
Calcium carbonate equivalent: 25 to 35 percent
Reaction: pH 7.9 to 8.4

Bkg3 horizon
Hue: 10YR, 2.5Y, 5Y, or N
Value: 4 or 5 moist; 6 or 7 dry
Chroma: 1 or 2
Clay content: 10 to 20 percent
Content of rock fragments: 60 to 70 percent—5 to 15 percent cobbles; 55 to 65 percent pebbles

Calcium carbonate equivalent: 20 to 35 percent
Reaction: pH 7.9 to 8.4

Burnette Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountain slopes
Parent material: Alluvium
Slope range: 4 to 35 percent
Mean annual precipitation: 18 to 24 inches
Annual air temperature: 39 to 42 degrees F
Frost-free period: 60 to 90 days

Taxonomic Class: Fine, montmorillonitic Argic Pachic Cryoborolls

Typical Pedon

Burnette stony clay loam, in an area of Adel-Burnette-Bynum complex, 4 to 35 percent slopes, in an area of rangeland, 700 feet north and 1,000 feet west of the southeast corner of sec. 14, T. 27 N., R. 9 W.

A1—0 to 7 inches; very dark grayish brown (10YR 3/2) stony clay loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; soft, friable, slightly sticky, slightly plastic; many fine roots; 10 percent pebbles and 5 percent stones; neutral; clear smooth boundary.

A2—7 to 14 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate medium prismatic structure parting to strong medium subangular blocky; slightly hard, firm, moderately sticky, moderately plastic; many fine roots; neutral; clear smooth boundary.

Bt1—14 to 21 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to strong medium subangular blocky; hard, firm, moderately sticky, moderately plastic; common very fine and fine roots; common distinct clay films on faces of peds; neutral; gradual wavy boundary.

Bt2—21 to 30 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, firm, moderately sticky, moderately plastic; common very fine roots; common distinct clay films on faces of peds; slightly alkaline; gradual wavy boundary.

Bk—30 to 60 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, firm, moderately sticky, moderately plastic; common fine soft masses of lime; strongly effervescent; moderately alkaline; few very fine roots.

Range in Characteristics

Soil temperature: 38 to 46 degrees F
Thickness of the mollic epipedon: 16 to 35 inches
Depth to the Bk horizon: 20 to 40 inches

A horizons
Value: 2 to 5 dry; 2 or 3 moist
Chroma: 1 or 2
Clay content: 27 to 40 percent
Content of rock fragments: 0 to 30 percent—0 to 15 percent stones and cobbles; 0 to 15 percent pebbles
Reaction: pH 6.1 to 7.3

Bt horizons
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 1 to 3
Texture: Clay loam, silty clay, or clay
Clay content: 35 to 50 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Reaction: pH 6.6 to 7.8

Bk horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 1 to 4
Texture: Silty clay loam, clay loam, or silty clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

Bynum Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and mountain slopes
Parent material: Semiconsolidated sedimentary beds and interbedded sandstone and shale
Slope range: 4 to 35 percent
Mean annual precipitation: 18 to 21 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 60 to 90 days

Taxonomic Class: Fine-loamy, mixed Typic Cryoborolls

Typical Pedon

Bynum loam, in an area of Bynum-Adel-Doby complex, 4 to 35 percent slopes, in an area of rangeland, 1,900 feet north and 200 feet east of the southwest corner of sec. 7, T. 27 N., R. 8 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/1) moist; moderate medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; many fine irregular pores; neutral; clear smooth boundary.

Bw—6 to 15 inches; dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine roots; many fine irregular pores; neutral; gradual smooth boundary.

Bk—15 to 28 inches; pale brown (10YR 6/3) loam, dark brown or brown (10YR 4/3) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; hard, friable, moderately sticky, slightly plastic; many very fine and fine roots; many very fine and fine irregular pores; few fine threads of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—28 to 34 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak thin platy structure; hard, friable, nonsticky, nonplastic; few very fine roots; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cr—34 to 60 inches; light brownish gray (10YR 6/2) semiconsolidated sedimentary beds; strongly effervescent; moderately alkaline; very hard when dry but crushes under pressure when wet.

Range in Characteristics

Soil temperature: 38 to 40 degrees F
Thickness of the mollic epipedon: 10 to 16 inches
Depth to the Bk horizon: 11 to 25 inches
Depth to the Cr horizon: 20 to 40 inches

A horizon
Value: 3 to 5 dry; 1 to 3 moist
Chroma: 1 or 2
Clay content: 20 to 27 percent
Reaction: pH 6.6 to 7.8

Bw horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 or 5 dry; 3 to 5 moist
Chroma: 1 or 2
Texture: Loam or clay loam
Clay content: 20 to 35 percent
Reaction: pH 7.4 to 8.4

Bk horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 8 dry; 4 to 6 moist
Chroma: 1 to 3
Texture: Loam, silty clay loam, or clay loam
Clay content: 20 to 35 percent
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 9.0

C horizon
Texture: Loam, silty clay loam, or clay loam
Clay content: 20 to 35 percent
Reaction: pH 7.9 to 9.0

194E—Bynum-Adel-Doby complex, 4 to 35 percent slopes

Setting

Landform:
- Bynum—Hills
- Adel—Hills
- Doby—Hills

Position on landform:
- Bynum—Backslopes and footslopes
- Adel—Backslopes and footslopes
- Doby—Shoulders and summits

Slope:
- Bynum—4 to 35 percent
- Adel—4 to 35 percent
- Doby—4 to 35 percent

Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 18 to 20 inches
Frost-free period: 60 to 90 days

Composition

Major Components
Bynum and similar soils: 35 percent
Adel and similar soils: 25 percent
Doby and similar soils: 25 percent

Minor Components
Burnette and similar soils: 0 to 5 percent
Fifer and similar soils: 0 to 3 percent
Teton and similar soils: 0 to 3 percent
Cheadle and similar soils: 0 to 2 percent
Gallatin and similar soils: 0 to 2 percent

Major Component Description

Bynum
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)

Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.2 inches

Adel
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.4 inches

Doby
Surface layer texture: Clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Cabba Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and escarpments
Parent material: Material derived from semiconsolidated sedimentary beds
Slope range: 2 to 60 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy, mixed (calcareous), frigid, shallow Typic Ustorthents

Typical Pedon

Cabba loam, in an area of Cabba-Roundor-Windham complex, 25 to 60 percent slopes, in an area of rangeland, 1,300 feet north and 400 feet west of the southeast corner of sec. 8, T. 25 N., R. 7 W.

A—0 to 3 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; many fine roots; many fine irregular pores; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk1—3 to 8 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many fine roots; slightly alkaline; clear smooth boundary.

Bk2—8 to 15 inches; light olive gray (5Y 6/2) loam with 20 percent small fragments of weakly consolidated siltstone, olive gray (5Y 5/2) moist; massive; slightly hard, very friable, slightly sticky, nonplastic; common very fine and fine roots; common very fine and fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

Cr—15 to 60 inches; light olive gray (5Y 6/2) semiconsolidated siltstone, olive gray (5Y 6/2) moist; roots in cracks in upper few inches; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Cr horizon: 10 to 20 inches

A horizon
Hue: 10YR or 2.5Y
Value: 3 to 6 dry; 3 or 4 moist
Chroma: 1 to 4
Clay content: 10 to 27 percent
Content of rock fragments: 0 to 60 percent—0 to 40 percent boulders, stones, and cobbles; 0 to 30 percent pebbles or channers
Electrical conductivity: 0 to 4 mmhos/cm
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 9.0

Bk horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 8 dry; 4 to 7 moist
Chroma; 1 to 4 or 6
Texture: Loam, silt loam, clay loam, or silty clay loam
Clay content: 20 to 35 percent
Structure: Massive thin platy, subangular blocky, or prismatic

Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent pebbles or channers
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 2 to 8 mmhos/cm
Effervescence: Slightly to violently
Reaction: pH 7.4 to 9.0

Cr horizon
This horizon consists of interbedded layers of silt, sand, and clay or a mixture of the three. They crush to loam, silt loam, very fine sandy loam, clay loam, or silty clay loam. Some layers are harder than others, but all are considered rippable, or soft, and are readily dug with power tools.
Reaction: pH 7.4 to 8.4

174E—Cabba-Amor loams, 15 to 35 percent slopes

Setting

Landform:
- Cabba—Hills
- Amor—Hills

Position on landform:
- Cabba—Shoulders and summits
- Amor—Backslopes and shoulders

Slope:
- Cabba—15 to 35 percent
- Amor—15 to 35 percent

Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Cabba and similar soils: 55 percent
Amor and similar soils: 30 percent

Minor Components
Areas of rock outcrop: 0 to 5 percent
Roundor and similar soils: 0 to 5 percent
Castner and similar soils: 0 to 3 percent
Windham and similar soils: 0 to 2 percent

Major Component Description

Cabba
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

Amor
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

271F—Cabba-Castner-Rock outcrop complex, 25 to 60 percent slopes

Setting

Landform:
- Cabba—Escarpments
- Castner—Escarpments
- Rock outcrop—Escarpments

Slope:
- Cabba—25 to 60 percent
- Castner—25 to 60 percent
- Rock outcrop—25 to 60 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Cabba and similar soils: 35 percent
Castner and similar soils: 30 percent
Rock outcrop: 20 percent

Minor Components
Wayden and similar soils: 0 to 7 percent
Amor and similar soils: 0 to 5 percent
Roundor and similar soils: 0 to 3 percent

Major Component Description

Cabba
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)

Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

Castner
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.2 inches

Rock outcrop
Definition: Weakly to strongly indurated sandstone

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

474F—Cabba-Roundor-Windham complex, 25 to 60 percent slopes

Setting

Landform:
- Cabba—Hills
- Roundor—Hills
- Windham—Hills

Position on landform:
- Cabba—Backslopes
- Roundor—Backslopes and footslopes
- Windham—Risers

Slope:
- Cabba—25 to 60 percent
- Roundor—25 to 60 percent
- Windham—25 to 60 percent

Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Cabba and similar soils: 40 percent
Roundor and similar soils: 30 percent
Windham and similar soils: 15 percent

Minor Components
Amor and similar soils: 0 to 6 percent
Kiev and similar soils: 0 to 6 percent
Judith and similar soils: 0 to 3 percent

Major Component Description

Cabba
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

Roundor
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.3 inches

Windham
Surface layer texture: Very gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

574E—Cabba-Wayden-Castner complex, 4 to 35 percent slopes

Setting

Landform:
- Cabba—Hills
- Wayden—Hills
- Castner—Hills

Slope:
- Cabba—4 to 35 percent
- Wayden—4 to 35 percent
- Castner—4 to 35 percent

Elevation: 4,000 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Cabba and similar soils: 35 percent
Wayden and similar soils: 30 percent
Castner and similar soils: 20 percent

Minor Components
Areas of rock outcrop: 0 to 9 percent
Amor and similar soils: 0 to 3 percent
Winifred and similar soils: 0 to 3 percent

Major Component Description

Cabba
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

Wayden
Surface layer texture: Silty clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.9 inches

Castner
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Cabbart Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Sedimentary plains and hills
Parent material: Semiconsolidated sedimentary beds
Slope range: 2 to 70 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Loamy, mixed (calcareous), frigid, shallow Aridic Ustorthents

Typical Pedon

Cabbart loam, in an area of Cabbart-Delpoint-Rock outcrop complex, 25 to 70 percent slopes, in an area of rangeland, 50 feet south and 750 feet east of the northwest corner of sec. 33, T. 30 N., R. 3 W.

A—0 to 3 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky, nonplastic; many fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk—3 to 11 inches; pale brown (10YR 6/3) loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure; hard, friable, slightly sticky, nonplastic; many very fine and fine roots; many fine pores; few fine threads of soft lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Cr1—11 to 14 inches; mixed grayish brown (2.5Y 5/2) and pale brown (10YR 6/3) weathered platy siltstone and slightly indurated sandstone with 20 percent soil between plates, grayish brown (2.5Y 5/2) moist; common very fine and fine roots between cracks and plates; few fine soft masses of lime on undersides of plates; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cr2—14 to 26 inches; mixed grayish brown (2.5Y 5/2) and pale brown (10YR 6/3) thin platy siltstone and slightly indurated sandstone; few very fine and fine roots between plates and cracks in the

upper few inches; strongly effervescent; strongly alkaline; gradual wavy boundary.

Cr3—26 to 60 inches; mixed grayish brown (2.5Y 5/2) and pale brown (10YR 6/3) thin to medium soft siltstone with thin strata of slightly indurated sandstone; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Cr horizon: 10 to 20 inches

A horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 3 to 5 moist
Chroma: 2 to 4
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 60 percent hard fragments—0 to 20 percent cobbles; 0 to 50 percent pebbles
Electrical conductivity: 0 to 4 mmhos/cm
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 9.0

Bk horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, clay loam, silt loam, or silty clay loam
Clay content: 18 to 35 percent
Structure: Massive, prismatic, or blocky
Content of rock fragments: 0 to 45 percent—0 to 15 percent hard pebbles; 0 to 45 percent soft pebbles
Electrical conductivity: 0 to 8 mmhos/cm
Sodium adsorption ratio: 0 to 5
Calcium carbonate equivalent: 15 to 25 percent
Reaction: pH 7.4 to 9.0

173E—Cabbart-Delpoint loams, 15 to 35 percent slopes

Setting

Landform:
- Cabbart—Hills
- Delpoint—Hills

Position on landform:
- Cabbart—Shoulders and summits
- Delpoint—Backslopes and footslopes

Slope:
- Cabbart—15 to 35 percent
- Delpoint—15 to 35 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Cabbart and similar soils: 50 percent
Delpoint and similar soils: 35 percent

Minor Components
Yamacall and similar soils: 0 to 6 percent
Kremlin and similar soils: 0 to 5 percent
Hillon and similar soils: 0 to 4 percent

Major Component Description

Cabbart
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

273F—Cabbart-Delpoint-Rock outcrop complex, 25 to 70 percent slopes

Setting

Landform:
- Cabbart—Hills
- Delpoint—Hills
- Rock outcrop—Hills

Position on landform:
- Cabbart—Shoulders and summits
- Delpoint—Backslopes and footslopes
- Rock outcrop—Summits

Slope:
- Cabbart—25 to 70 percent
- Delpoint—25 to 45 percent
- Rock outcrop—25 to 70 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Cabbart and similar soils: 45 percent
Delpoint and similar soils: 25 percent
Rock outcrop: 15 percent

Minor Components
Yamacall and similar soils: 0 to 7 percent
Yawdim and similar soils: 0 to 6 percent
Kremlin and similar soils: 0 to 2 percent

Major Component Description

Cabbart
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.9 inches

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.1 inches

Rock outcrop
Definition: Weakly to strongly indurated sandstone

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Castner Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and escarpments
Parent material: Residuum from hard sandstone
Slope range: 4 to 60 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy-skeletal, mixed Lithic Haploborolls

Typical Pedon

Castner channery loam, in an area of Cabba-Wayden-Castner complex, 4 to 35 percent slopes, in an area of rangeland, 500 feet south and 1,900 feet west of the northeast corner of sec. 11, T. 24 N., R. 8 W.

A1—0 to 4 inches; dark brown (10YR 4/3) channery loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky, nonplastic; many fine and medium roots; 30 percent channers; few thin lime coats on undersides of larger rock fragments; slightly alkaline; clear wavy boundary.

A2—4 to 8 inches; brown (10YR 5/3) very channery loam, dark brown (10YR 3/3) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky, nonplastic; many fine and few medium roots; 55 percent channers; lime crusts on undersides of rock fragments; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk—8 to 14 inches; brown (10YR 5/3) extremely flaggy loam, dark brown (10YR 4/3) moist; weak thin platy; slightly hard, very friable, slightly sticky, nonplastic; common fine and few medium roots between plates; 50 percent channers and 25 percent flagstones; line crusts on undersides of rock fragments; strongly effervescent; moderately alkaline; abrupt wavy boundary.

R—14 inches; hard sandstone.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Thickness of the mollic epipedon: 7 to 15 inches
Depth to bedrock: 10 to 20 inches
Depth to the Bk horizon: 7 to 15 inches
Other features: Some pedons have a thin Bw horizon.

A1 horizon
Hue: 2.5Y, 10YR, 7.5YR, or 5YR
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 to 3
Clay content: 10 to 18 percent with less than 35 percent fine and coarser sand
Content of rock fragments: 5 to 45 percent—0 to 15 percent stones and cobbles; 5 to 30 percent pebbles and channers
Reaction: pH 6.6 to 7.8

A2 horizon
Hue: 2.5Y, 10YR, 7.5YR, or 5YR
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 to 3
Texture: Loam or sandy loam
Clay content: 10 to 18 percent with less than 35 percent fine and coarser sand
Content of rock fragments: 35 to 70 percent—5 to 20 percent stones and cobbles; 30 to 55 percent pebbles and channers
Reaction: pH 6.6 to 8.4

Bk horizon
Hue: 2.5Y, 10YR, 7.5YR, or 5YR
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 or 3
Texture: Loam or sandy loam
Clay content: 10 to 18 percent with less than 35 percent fine and coarser sand
Content of rock fragments: 35 to 80 percent—10 to 25 percent stones and flagstones; 25 to 60 percent pebbles and channers
Calcium carbonate equivalent: 3 to 15 percent
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 6.6 to 8.4

Cheadle Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and mountain slopes
Parent material: Residuum from hard sandstone
Slope range: 4 to 60 percent
Mean annual precipitation: 18 to 24 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 55 to 90 days

Taxonomic Class: Loamy-skeletal, mixed Lithic Cryoborolls

Typical Pedon

Cheadle stony loam, in an area of Teton-Tibson-Cheadle complex, 4 to 35 percent slopes, in an area of rangeland, 2,000 feet south and 1,000 feet west of the northeast corner of sec. 30, T. 25 N., R. 8 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) stony loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure parting to moderate medium granular; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium roots; 20 percent channers and 3 percent stones on the surface; slightly alkaline; clear smooth boundary.
A2—5 to 10 inches; dark grayish brown (10YR 4/2) very channery loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable, slightly sticky, moderately plastic; common fine roots; 40 percent channers; slightly alkaline; gradual smooth boundary.
C—10 to 18 inches; grayish brown (10YR 5/2) very channery loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky, moderately plastic; few very fine and fine roots; 50 percent channers; slightly effervescent; moderately alkaline; abrupt smooth boundary.
R—18 inches; fractured hard sandstone interbedded with semiconsolidated sandy shale.

Range in Characteristics

Soil temperature: 37 to 47 degrees F; mean summer temperature of less than 59 degrees F.
Thickness of the mollic epipedon: 7 to 16 inches
Depth to bedrock: 10 to 20 inches

A1 horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 or 2
Clay content: 10 to 27 percent
Content of rock fragments: 0 to 60 percent—0 to 50 percent stones, cobbles, and channers; 0 to 10 percent pebbles
Reaction: pH 6.6 to 7.8

A2 horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 1 to 3
Texture: Loam, fine sandy loam, or sandy loam
Clay content: 10 to 27 percent

Content of rock fragments: 35 to 75 percent—0 to 65 percent stones, cobbles, and channers; 10 to 30 percent pebbles
Effervescence: Slightly or strongly
Reaction: pH 7.4 to 9.0

C horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Loam, fine sandy loam, or sandy loam
Clay content: 10 to 27 percent
Content of rock fragments: 35 to 75 percent—0 to 65 percent stones, cobbles, and channers; 20 to 30 percent pebbles
Calcium carbonate equivalent: 3 to 5 percent
Reaction: pH 7.4 to 9.0

390F—Cheadle-Doby-Rock outcrop complex, 15 to 60 percent slopes

Setting

Landform:
- Cheadle—Mountains
- Doby—Mountains
- Rock outcrop—Mountains

Position on landform:
- Cheadle—Shoulders and summits
- Doby—Backslopes and shoulders
- Rock outcrop—Summits of mountains

Slope:
- Cheadle—15 to 60 percent
- Doby—15 to 60 percent
- Rock outcrop—15 to 60 percent

Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 19 to 22 inches
Frost-free period: 55 to 80 days

Composition

Major Components
Cheadle and similar soils: 35 percent
Doby and similar soils: 25 percent
Rock outcrop: 25 percent

Minor Components
Fifer and similar soils: 0 to 6 percent
Teton and similar soils: 0 to 4 percent
Shedhorn and similar soils: 0 to 3 percent
Adel and similar soils: 0 to 2 percent

Major Component Description

Cheadle
Surface layer texture: Stony loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 1.6 inches

Doby
Surface layer texture: Clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 2.4 inches

Rock outcrop
Definition: Sandstone or shale bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

904F—Cheadle-Adel-Doby complex, 15 to 60 percent slopes

Setting

Landform:
- Cheadle—Hills
- Adel—Hills
- Doby—Hills

Position on landform:
- Cheadle—Backslopes and shoulders
- Adel—Backslopes and footslopes
- Doby—Backslopes and shoulders

Slope:
- Cheadle—15 to 60 percent
- Adel—15 to 60 percent
- Doby—15 to 35 percent

Elevation: 4,600 to 6,000 feet
Mean annual precipitation: 18 to 20 inches
Frost-free period: 60 to 90 days

Composition

Major Components
Cheadle and similar soils: 35 percent
Adel and similar soils: 30 percent
Doby and similar soils: 20 percent

Minor Components
Fifer and similar soils: 0 to 4 percent
Teton and similar soils: 0 to 4 percent
Bynum and similar soils: 0 to 3 percent
Shedhorn and similar soils: 0 to 3 percent
Gallatin and similar soils: 0 to 1 percent

Major Component Description

Cheadle
Surface layer texture: Stony loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 1.6 inches

Adel
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.3 inches

Doby
Surface layer texture: Clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Chinook Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Glaciated till plains, hills, alluvial fans, and stream terraces
Parent material: Alluvium or eolian material
Slope range: 0 to 15 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Coarse-loamy, mixed Aridic Haploborolls

Typical Pedon

Chinook fine sandy loam, 0 to 8 percent slopes, in an area of nonirrigated cropland, 1,500 feet north and 100 feet east of the southwest corner of sec. 26, T. 28 N., R. 2 E.

Ap—0 to 6 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, nonsticky, nonplastic; many very fine and fine roots; slightly alkaline; abrupt smooth boundary.

Bw—6 to 12 inches; dark yellowish brown (10YR 4/4) fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak coarse prismatic structure; soft, very friable, nonsticky, nonplastic; many very fine and fine roots; common very fine and fine pores; neutral; gradual smooth boundary.

Bk1—12 to 36 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure; soft, very friable, nonsticky, nonplastic; many very fine roots in the lower part; few very fine tubular pores; few fine soft threadlike masses of lime; strongly effervescent; moderately alkaline; diffuse wavy boundary.

Bk2—36 to 42 inches; light brownish gray (10YR 6/2) fine sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky, nonplastic; common very fine roots; few very fine tubular pores; few fine soft threadlike masses of lime; strongly effervescent; moderately alkaline; diffuse wavy boundary.

BC—42 to 60 inches; pale brown (10YR 6/3) loamy fine sand and fine sandy loam, brown (10YR 5/3) moist; massive; loose, nonsticky, nonplastic; few very fine roots; slightly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 15 inches
Depth to the Bk horizon: 10 to 35 inches

Ap horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist
Chroma: 2 or 3
Clay content: 5 to 18 percent

Content of rock fragments: 0 to 35 percent pebbles
Reaction: pH 6.6 to 8.4

Bw horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 to 4
Texture: Fine sandy loam or sandy loam
Clay content: 5 to 18 percent; more than 50 percent medium, fine, and coarser sand
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.6 to 8.4

Bk1 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Fine sandy loam or sandy loam
Clay content: 5 to 15 percent; more than 50 percent medium, fine, and coarser sand
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 3 to 12 percent
Reaction: pH 7.4 to 9.0

Bk2 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Fine sandy loam or sandy loam
Clay content: 5 to 15 percent; more than 50 percent medium, fine, and coarser sand
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent—few and common masses and threads of lime
Reaction: pH 7.4 to 9.0

BC horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Fine sandy loam, sandy loam, loamy fine sand, or loamy sand
Clay content: 5 to 15 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 7.4 to 9.0

34C—Chinook fine sandy loam, 0 to 8 percent slopes

Setting

Landform: Till plains
Slope: 0 to 8 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Chinook and similar soils: 90 percent

Minor Components
Assinniboine and similar soils: 0 to 5 percent
Joplin and similar soils: 0 to 4 percent
Telstad and similar soils: 0 to 1 percent

Major Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or eolian material
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

334C—Chinook-Joplin complex, 2 to 8 percent slopes

Setting

Landform:
- Chinook—Till plains
- Joplin—Till plains

Position on landform:
- Chinook—Footslopes and toeslopes
- Joplin—Shoulders and summits

Slope:
- Chinook—2 to 8 percent
- Joplin—2 to 8 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Chinook and similar soils: 50 percent
Joplin and similar soils: 35 percent

Minor Components
Telstad and similar soils: 0 to 8 percent
Assinniboine and similar soils: 0 to 4 percent
Kremlin and similar soils: 0 to 3 percent

Major Component Description

Chinook
Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or eolian material
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.2 inches

Joplin
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

434B—Chinook-Kremlin complex, 0 to 4 percent slopes

Setting

Landform:
- Chinook—Alluvial fans and stream terraces
- Kremlin—Alluvial fans and stream terraces

Position on landform:
- Chinook—Shoulders
- Kremlin—Footslopes and toeslopes

Slope:
- Chinook—0 to 4 percent
- Kremlin—0 to 4 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Chinook and similar soils: 45 percent
Kremlin and similar soils: 45 percent

Minor Components
Yamacall and similar soils: 0 to 7 percent
Rothiemay and similar soils: 0 to 3 percent

Major Component Description

Chinook
Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or eolian material
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.2 inches

Kremlin
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

534D—Chinook-Twilight fine sandy loams, 2 to 15 percent slopes

Setting

Landform:
- Chinook—Hills
- Twilight—Hills

Position on landform:
- Chinook—Backslopes and footslopes
- Twilight—Backslopes and shoulders

Slope:
- Chinook—2 to 15 percent
- Twilight—2 to 15 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Chinook and similar soils: 50 percent
Twilight and similar soils: 40 percent

Minor Components
Assinniboine and similar soils: 0 to 5 percent
Yetull and similar soils: 0 to 3 percent
Kremlin and similar soils: 0 to 2 percent

Major Component Description

Chinook
Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or eolian material
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.2 inches

Twilight
Surface layer texture: Fine sandy loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, sandy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Crago Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to 22 inches; moderately rapid below this depth
Landform: Relict stream terraces and hills
Parent material: Alluvium
Slope range: 0 to 60 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Loamy-skeletal, carbonatic, frigid Haplocalcidic Ustochrepts

Typical Pedon

Crago gravelly loam, in an area of Niart-Crago gravelly loams, 0 to 4 percent slopes, in an area of irrigated cropland, 2,040 feet north and 400 feet west of the southeast corner of sec. 26, T. 22 N., R. 1 W.

Ap—0 to 6 inches; brown (2.5Y 5/3) gravelly loam, dark brown (2.5Y 4/3) moist; moderate medium granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common fine roots; many fine vesicular pores; 15 percent pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—6 to 10 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; common very fine and fine irregular pores; 20 percent pebbles with lime coats; few fine and medium soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—10 to 22 inches; light gray (10YR 7/2) very gravelly loam, pale brown (10YR 6/3) moist; massive; hard, friable, slightly sticky, slightly plastic; few very fine and fine roots; common fine pores; 55 percent pebbles with lime coats on upper sides and lime crusts on undersides; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk3—22 to 60 inches; light gray (10YR 7/2) extremely gravelly sandy loam, pale brown (10YR 6/3) moist; single grain; loose, very friable, nonsticky, nonplastic; 60 percent pebbles and 20 percent cobbles; lime crusts on undersides of larger pebbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Other features: When mixed to 7 inches, the surface horizon does not meet the requirements for a mollic epipedon.

Ap horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 or 3
Clay content: 15 to 27 percent
Content of rock fragments: 0 to 75 percent—0 to 30 percent stones and cobbles; 0 to 45 percent pebbles
Reaction: pH 7.4 to 8.4

Bk1 horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 15 to 75 percent—0 to 30 percent stones and cobbles; 15 to 60 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent in the fine earth fraction; 40 percent for the whole soil including coarse rock fragments less than $^3/_4$ inch in size
Reaction: pH 7.4 to 8.4

Bk2 and Bk3 horizons
Hue: 2.5Y or 10YR
Value: 6 to 8 dry; 4 to 7 moist
Chroma: 2 to 4
Texture: Sandy loam, loam, sandy clay loam, or clay loam
Clay content: 18 to 30 percent
Content of rock fragments: 35 to 85 percent—0 to 30 percent stones and cobbles; 35 to 60 percent pebbles
Calcium carbonate equivalent: 15 to 30 percent in the fine earth fraction; 40 to 70 percent for the whole soil including coarse rock fragments less than $^3/_4$ inch in size
Reaction: pH 7.4 to 8.4

15B—Crago gravelly loam, 0 to 4 percent slopes

Setting

Landform: Relict stream terraces
Slope: 0 to 4 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Crago and similar soils: 90 percent

Minor Components
Arrod and similar soils: 0 to 4 percent
Niart and similar soils: 0 to 3 percent
Rothiemay and similar soils: 0 to 3 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

15C—Crago gravelly loam, 4 to 8 percent slopes

Setting

Landform: Relict stream terraces
Slope: 4 to 8 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Crago and similar soils: 90 percent

Minor Components
Arrod and similar soils: 0 to 4 percent
Niart and similar soils: 0 to 3 percent
Rothiemay and similar soils: 0 to 3 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Creed Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Alluvial fans and stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic Typic Natriboralfs

Typical Pedon

Creed loam, in an area of Creed-Gerdrum complex, 0 to 4 percent slopes, in an area of rangeland, 2,000 feet south and 1,800 feet east of the northwest corner of sec. 16, T. 23 N., R. 1 W.

E—0 to 5 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 5/2) moist; weak medium platy structure parting to moderate fine granular; slightly hard, very friable, slightly sticky, slightly plastic; many fine roots; many fine vesicular pores; common unstained silt and sand grains; slightly alkaline; abrupt wavy boundary.

Btn1—5 to 10 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; strong medium columnar structure parting to moderate medium subangular blocky; very hard, firm, moderately sticky, very plastic; common very fine and fine roots; common very fine pores; common distinct clay films on faces of peds; light gray (10YR 6/1) skeletons on tops of columns; many unstained sand and silt grains on ped faces; slightly alkaline; gradual wavy boundary.

Btn2—10 to 20 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; strong medium prismatic structure parting to moderate medium angular blocky; very hard, firm, moderately sticky, very plastic; common very fine and fine roots; few very fine and fine pores; common distinct clay films on faces of peds and as bridges between sand grains; slightly alkaline; clear wavy boundary.

Bkn—20 to 26 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, moderately sticky, very plastic; few fine roots; few very fine and fine pores; common soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bkny—26 to 53 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; moderately sticky, moderately plastic; few very fine roots; common medium threadlike seams of gypsum and lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bnyz—53 to 60 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; massive; very hard, firm, moderately sticky, moderately plastic; few fine threads of gypsum and other salts; slightly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to gypsum and other salts: 22 to 30 inches

E horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 7 moist
Chroma: 2 or 3
Clay content: 20 to 27 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.1 to 8.4

Btn horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 or 3
Texture: Clay loam, silty clay loam, clay, or silty clay
Clay contents: 35 to 55 percent
Content of rock fragments: 0 to 15 percent pebbles
Electrical conductivity: 2 to 4 mmhos/cm; sandy substratum phase 0 to 2 mmhos/cm
Sodium adsorption ratio: 8 to 13
Reaction: pH 6.6 to 9.0

Bkn and Bkny horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Silty clay loam, clay loam, sandy clay loam, loam, or clay
Content of rock fragments: 0 to 15 percent pebbles

Clay content: 25 to 45 percent
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 4 to 8 mmhos/cm
Sodium adsorption ratio: 13 to 20
Gypsum: 0 to 2 percent
Reaction: pH 7.9 to 9.0

Bnyz horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy clay loam that is thinly stratified or stratified with thin layers of coarser material or silty clay loam
Clay content: 25 to 35 percent
Content of rock fragments: 0 to 15 percent pebbles
Electrical conductivity: 4 to 16 mmhos/cm
Sodium adsorption ratio: 13 to 25
Gypsum: 1 to 5 percent
Reaction: pH 7.9 to 9.0

131B—Creed-Gerdrum complex, 0 to 4 percent slopes

Setting

Landform:
• Creed—Alluvial fans and stream terraces
• Gerdrum—Alluvial fans and stream terraces
Position on landform:
• Creed—Microhighs
• Gerdrum—Microlows
Slope:
• Creed—0 to 4 percent
• Gerdrum—0 to 4 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Creed and similar soils: 60 percent
Gerdrum and similar soils: 25 percent

Minor Components
Absher and similar soils: 0 to 8 percent
Ethridge and similar soils: 0 to 5 percent
Lardell and similar soils: 0 to 2 percent

Major Component Description

Creed
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.6 inches

Gerdrum
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 7.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

137B—Creed-Absher complex, 0 to 4 percent slopes

Setting

Landform:
• Creed—Alluvial fans and stream terraces
• Absher—Alluvial fans and stream terraces
Position on landform:
• Creed—Microhighs
• Absher—Microlows
Slope:
• Creed—0 to 4 percent
• Absher—0 to 4 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Creed and similar soils: 60 percent
Absher and similar soils: 25 percent

Minor Components
Gerdrum and similar soils: 0 to 7 percent
Marvan and similar soils: 0 to 6 percent
Lardell and similar soils: 0 to 2 percent

Major Component Description

Creed
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.4 inches

Absher
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 5.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Delpoint Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Sedimentary plains and hills
Parent material: Semiconsolidated sedimentary beds
Slope range: 2 to 45 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy, mixed, frigid Aridic Ustochrepts

Typical Pedon

Delpoint loam, in an area of Cabbart-Delpoint-Rock outcrop complex, 25 to 70 percent slopes, in an area of rangeland, 2,600 feet south and 800 feet west of the northeast corner of sec. 29, T. 30 N., R. 3 W.

A—0 to 5 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky, nonplastic; many fine pores; strongly effervescent; slightly alkaline; clear smooth boundary.

Bw—5 to 15 inches; pale brown (10YR 6/3) loam, dark, grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, very friable, slightly sticky, nonplastic; common very fine and fine roots; many very fine and fine pores; few fine threads of soft lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk—15 to 25 inches; pale brown (10YR 6/3) loam, dark grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure; hard, very friable, slightly sticky, nonplastic; common very fine and fine roots; many very fine and fine pores; common fine threads of soft lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Cr1—25 to 34 inches; mixed light brownish gray (2.5Y 6/2) and pale brown (10YR 6/3) shale; strongly effervescent; strongly alkaline; gradual wavy boundary.

Cr2—34 to 60 inches; mixed grayish brown (2.5Y 5/2) and pale brown (10YR 6/3) siltstone interbedded with thin strata of slightly indurated sandstone; few roots between plates in upper few inches; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Bk horizon: 10 to 20 inches
Depth to bedrock: 20 to 40 inches
Soil phases: Calcareous (more than 5 percent lime)

A horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 3 to 5 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 0 to 20 percent pebbles
Effervescence: None to strongly
Reaction: pH 6.6 to 8.4
Other features: When mixed to 7 inches, the surface will not meet the requirements for a mollic epipedon.

Bw horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or silty clay loam
Clay content: 18 to 35 percent

Content of rock fragments: 0 to 15 percent pebbles
Effervescence: None to violently
Reaction: pH 6.6 to 8.4

Bk horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, sandy loam, clay loam, or silty clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent. There is not more than a 5-percent difference in calcium carbonate equivalent or by volume of secondary carbonates in the underlying horizon of material to meet the requirements of a calcic horizon.
Effervescence: Strongly or violently
Reaction: pH 7.4 to 9.0

176C—Delpoint-Cabbart loams, 2 to 15 percent slopes

Setting

Landform:
- Delpoint—Hills
- Cabbart—Hills

Position on landform:
- Delpoint—Backslopes and footslopes
- Cabbart—Shoulders and summits

Slope:
- Delpoint—2 to 15 percent
- Cabbart—2 to 15 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Delpoint and similar soils: 50 percent
Cabbart and similar soils: 35 percent

Minor Components
Yamacall and similar soils: 0 to 9 percent
Kremlin and similar soils: 0 to 6 percent

Major Component Description

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.8 inches

Cabbart
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

376F—Delpoint-Cabbart-Hillon complex, 25 to 60 percent slopes

Setting

Landform:
- Delpoint—Hills
- Cabbart—Hills
- Hillon—Hills

Position on landform:
- Delpoint—Backslopes
- Cabbart—Backslopes and shoulders
- Hillon—Backslopes and shoulders

Slope:
- Delpoint—25 to 45 percent
- Cabbart—25 to 60 percent
- Hillon—25 to 60 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Delpoint and similar soils: 40 percent
Cabbart and similar soils: 25 percent
Hillon and similar soils: 25 percent

Minor Components
Kevin and similar soils: 0 to 4 percent
Yamacall and similar soils: 0 to 4 percent
Kremlin and similar soils: 0 to 2 percent

Major Component Description

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.8 inches

Cabbart
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

Hillon
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

476D—Delpoint-Kremlin-Cabbart complex, 4 to 15 percent slopes

Setting

Landform:
- Delpoint—Hills
- Kremlin—Hills
- Cabbart—Hills

Position on landform:
- Delpoint—Backslopes and footslopes
- Kremlin—Footslopes and toeslopes
- Cabbart—Shoulders and summits

Slope:
- Delpoint—4 to 15 percent
- Kremlin—4 to 15 percent
- Cabbart—4 to 15 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Delpoint and similar soils: 35 percent
Kremlin and similar soils: 30 percent
Cabbart and similar soils: 20 percent

Minor Components
Yamacall and similar soils: 0 to 10 percent
Rothiemay and similar soils: 0 to 5 percent

Major Component Description

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.8 inches

Kremlin
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

Cabbart
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

576F—Delpoint-Cabbart-Crago complex, 15 to 60 percent slopes

Setting

Landform:
- Delpoint—Hills
- Cabbart—Hills
- Crago—Relict stream terraces

Position on landform:
- Delpoint—Backslopes and footslopes
- Cabbart—Backslopes and shoulders
- Crago—Shoulders

Slope:
- Delpoint—15 to 35 percent
- Cabbart—35 to 60 percent
- Crago—35 to 60 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Delpoint and similar soils: 40 percent
Cabbart and similar soils: 25 percent
Crago and similar soils: 20 percent

Minor Components
Yamacall and similar soils: 0 to 8 percent
Rothiemay and similar soils: 0 to 5 percent
Kremlin and similar soils: 0 to 2 percent

Major Component Description

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.8 inches

Cabbart
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

Crago
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

676C—Delpoint-Rothiemay clay loams, 2 to 8 percent slopes

Setting

Landform:
- Delpoint—Sedimentary plains
- Rothiemay—Sedimentary plains

Position on landform:
- Delpoint—Backslopes and shoulders
- Rothiemay—Footslopes

Slope:
- Delpoint—2 to 8 percent
- Rothiemay—2 to 8 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Delpoint and similar soils: 50 percent
Rothiemay and similar soils: 40 percent

Minor Components
Cabbart and similar soils: 0 to 5 percent
Rootel and similar soils: 0 to 3 percent
Varney and similar soils: 0 to 2 percent

Major Component Description

Delpoint
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained

Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.1 inches

Rothiemay
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

676D—Delpoint-Rothiemay clay loams, 8 to 15 percent slopes

Setting

Landform:
- Delpoint—Hills
- Rothiemay—Hills

Position on landform:
- Delpoint—Shoulders and summits
- Rothiemay—Backslopes and footslopes

Slope:
- Delpoint—8 to 15 percent
- Rothiemay—8 to 15 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Delpoint and similar soils: 45 percent
Rothiemay and similar soils: 40 percent

Minor Components
Cabbart and similar soils: 0 to 6 percent
Crago and similar soils: 0 to 6 percent
Kremlin and similar soils: 0 to 3 percent

Major Component Description

Delpoint
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.1 inches

Rothiemay
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

776C—Delpoint-Cabbart-Rootel loams, 2 to 15 percent slopes

Setting

Landform:
- Delpoint—Hills
- Cabbart—Hills
- Rootel—Hills

Position on landform:
- Delpoint—Footslopes
- Cabbart—Shoulders and summits
- Rootel—Footslopes

Slope:
- Delpoint—2 to 15 percent
- Cabbart—2 to 15 percent
- Rootel—2 to 15 percent

Elevation: 3,600 to 4,200 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Delpoint and similar soils: 35 percent
Cabbart and similar soils: 25 percent
Rootel and similar soils: 25 percent

Minor Components
Kremlin and similar soils: 0 to 5 percent
Marmarth and similar soils: 0 to 5 percent
Yamacall and similar soils: 0 to 5 percent

Major Component Description

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.8 inches

Cabbart
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

Rootel
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

876C—Delpoint-Kremlin-Vanda complex, 2 to 15 percent slopes

Setting

Landform:
- Delpoint—Hills
- Kremlin—Hills
- Vanda—Hills

Position on landform:
- Delpoint—Backslopes and shoulders
- Kremlin—Footslopes
- Vanda—Footslopes

Slope:
- Delpoint—2 to 15 percent
- Kremlin—2 to 15 percent
- Vanda—2 to 15 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Delpoint and similar soils: 35 percent
Kremlin and similar soils: 30 percent
Vanda and similar soils: 20 percent

Minor Components
Yamacall and similar soils: 0 to 7 percent
Marvan and similar soils: 0 to 5 percent
Cabbart and similar soils: 0 to 2 percent
McKenzie and similar soils: 0 to 1 percent

Major Component Description

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.9 inches

Kremlin
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained

Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

Vanda
Surface layer texture: Clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

46—Denied access

Composition

Major Components
Denied access: 100 percent

Major Component Description

Definition: Areas where mapping access was denied by the landowner

Doby Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Hills and mountain slopes
Parent material: Residuum from semiconsolidated shale
Slope range: 4 to 60 percent
Mean annual precipitation: 18 to 22 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 55 to 90 days

Taxonomic Class: Clayey, montmorillonitic, shallow Typic Cryoborolls

Typical Pedon

Doby clay loam, in an area of Bynum-Adel-Doby complex, 4 to 35 percent slopes, in an area of rangeland, 1,180 feet north and 320 feet east of the southwest corner of sec. 17, T. 26 N., R. 8 W.

A1—0 to 4 inches; gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; moderate medium granular structure; hard, firm, moderately sticky, moderately plastic; many fine roots; slight effervescent; slightly alkaline; clear smooth boundary.
A2—4 to 11 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure parting to strong medium granular; hard, very firm, moderately sticky, moderately plastic; many fine roots; neutral; clear smooth boundary.
C—11 to 18 inches; gray (10YR 5/1) clay loam, dark gray (10YR 4/1) moist; moderate medium subangular blocky structure; hard, very firm, moderately sticky, moderately plastic; few fine roots; slightly alkaline; 10 to 15 percent soft shale fragments; clear irregular boundary.
Cr—18 to 60 inches; grayish brown (10YR 5/2) semiconsolidated shale; very hard when dry and crushes under moderate pressure when wet.

Range in Characteristics

Soil temperature: 39 to 45 degrees F
Thickness of the mollic epipedon: 9 to 16 inches
Depth to the Cr horizon: 10 to 20 inches

A1 horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 1 or 2
Clay content: 35 to 40 percent
Reaction: pH 6.6 to 7.8

A2 horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 2 or 3
Texture: Clay loam, clay, or silty clay
Clay content: 35 to 55 percent
Reaction: pH 6.6 to 7.8

C horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 1 to 3
Texture: Clay loam, clay, or silty clay
Clay content: 35 to 55 percent
Reaction: pH 7.4 to 8.4

Dougcliff Series

Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Permeability: Rapid
Landform: Stream terraces
Parent material: Peat
Slope range: 0 to 1 percent
Mean annual precipitation: 17 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 100 days

Taxonomic Class: Euic Typic Borofibrists

Typical Pedon

Dougcliff mucky peat, in an area of Winginaw-Dougcliff mucky peats, 0 to 2 percent slopes, in an area of marshland, 800 feet south and 2,500 feet west of the northeast corner of sec. 13, T. 24 N., R. 8 W.

(Colors are for moist soil unless otherwise noted.)

Oi1—0 to 3 inches; black (10YR 2/1) and black (10YR 2/1) rubbed and pressed fibric material; 80 percent fiber and raw herbaceous plant material—70 percent rubbed; massive; nonsticky, nonplastic; 75 percent lycopodium mosses and 25 percent herbaceous species; neutral (pH 7.2 in water); clear wavy boundary.

Oi2—3 to 14 inches; dark reddish brown (5YR 3/2) and dark brown (7.5YR 3/2) rubbed and pressed fibric material; 90 percent fiber—80 percent rubbed; massive; nonsticky, nonplastic; 90 percent herbaceous species and 10 percent lycopodium mosses; neutral (pH 7.0 in water); clear wavy boundary.

Oi3—14 to 38 inches; dark reddish brown (5YR 2/2) and dark reddish brown (5YR 2/2) rubbed and pressed; 85 percent fiber—80 percent rubbed; massive; nonsticky, nonplastic; neutral (pH 7.2 in water); gradual wavy boundary.

Oi4—38 to 60 inches; dark reddish brown (5YR 3/2) and dark reddish brown (5YR 3/2) rubbed and pressed; 75 percent fiber, rubbed; massive; nonsticky, nonplastic; 95 percent herbaceous species; slightly alkaline (pH 7.4 in water).

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Depth of organic material: Greater than 51 inches
Depth to the seasonal high water table: 0 to 6 inches
Other features: Some pedons have mineral materials at depths of 51 to 60 inches. Some pedons have an Oe horizon.

Oi1 horizon
Hue: 10YR or 7.5YR
Chroma: 1 or 2
Fiber content: 80 to 90 percent unrubbed, 65 to 75 percent rubbed
Reaction: pH 6.1 to 7.8

Oi2 horizon
Hue: 10YR, 7.5YR, or 5YR
Value: 2 or 3 moist
Chroma: 1 or 2
Fiber content: 85 to 95 percent unrubbed, 75 to 85 percent rubbed
Reaction: pH 6.1 to 7.8

Oi3 horizon
Hue: 10YR, 7.5YR, or 5YR
Value: 2 or 3 moist
Fiber content: 80 to 70 percent unrubbed, 70 to 80 percent rubbed
Reaction: pH 6.6 to 7.8

Oi4 horizon
Hue: 10YR, 7.5YR, or 5YR
Value: 3 moist
Fiber content: 75 to 85 percent unrubbed, 60 to 75 percent rubbed
Reaction: pH 6.1 to 7.8

Ethridge Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Alluvial fans, stream terraces, and glaciated till plains
Parent material: Alluvium
Slope range: 0 to 8 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic Aridic Argiborolls

Typical Pedon

Ethridge silty clay loam, 0 to 4 percent slopes, in an area of nonirrigated cropland, 1,400 feet north and 1,800 feet west of the southeast corner of sec. 26, T. 25 N., R. 2 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable, moderately sticky, moderately

plastic; many fine roots; few pebbles; common fine irregular pores; neutral; clear smooth boundary.

Bt—6 to 13 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium angular and subangular blocky; very hard, firm, very sticky, very plastic; common very fine and fine roots; common very fine tubular pores; common distinct clay films; neutral; clear wavy boundary.

Bk1—13 to 19 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, very sticky, very plastic; common very fine roots; common very fine tubular pores; thin patchy clay films on vertical faces of peds; common fine and medium soft masses of lime; strongly effervescent; slightly alkaline; gradual wavy boundary.

Bk2—19 to 30 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, friable, very sticky, moderately plastic; few very fine roots; common fine tubular and irregular pores; common fine and medium soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk3—30 to 48 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y to 4/2) moist; massive; very hard, friable, very sticky, moderately plastic; few very fine roots; common very fine tubular and irregular pores; common fine and medium soft masses of lime; strongly effervescent; strongly alkaline; gradual wavy boundary.

Bky—48 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, very sticky, moderately plastic; common very fine irregular pores; common fine soft masses of gypsum; few fine soft masses of lime; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 14 inches; may include all or part of the Bt horizon.
Depth to the Bk horizon: 10 to 20 inches
Other features: In some pedons, the Bky horizon may not be stratified or present.

Ap horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist
Chroma: 2 or 3
Texture: Clay loam or silty clay loam
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 5 percent pebbles
Reaction: pH 6.1 to 7.8

Bt horizon
Hue: 10YR or 2.5Y
Value: 3 or 4 moist
Chroma: 2 to 4
Texture: Clay, silty clay, clay loam, or silty clay loam
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 5 percent pebbles
Reaction: pH 6.6 to 8.4

Bk horizons
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Clay, silty clay loam, loam, clay loam, or silty clay
Clay content: 25 to 45 percent
Content of rock fragments: 0 to 5 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 9.0

Bky horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Clay loam, silt loam, loam, or silty clay loam (these textures consist of strata of finer and coarser materials)
Clay content: 25 to 40 percent
Content of rock fragments: 0 to 5 percent pebbles
Electrical conductivity: 0 to 4 mmhos/cm
Calcium carbonate equivalent: 5 to 15 percent
Gypsum: 1 to 3 percent
Reaction: pH 7.4 to 9.0

39B—Ethridge silty clay loam, 0 to 4 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 4 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Ethridge and similar soils: 85 percent

Minor Components
Kobase and similar soils: 0 to 6 percent
Richey and similar soils: 0 to 5 percent
Marias and similar soils: 0 to 4 percent

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

439B—Ethridge clay loam, 0 to 4 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 4 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Ethridge and similar soils: 90 percent

Minor Components
Kobase and similar soils: 0 to 4 percent
Richey and similar soils: 0 to 4 percent
Marias and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

539B—Ethridge-Nunemaker silty clay loams, 0 to 4 percent slopes

Setting

Landform:
- Ethridge—Till plains
- Nunemaker—Till plains

Position on landform:
- Ethridge—Footslopes and toeslopes
- Nunemaker—Shoulders

Slope:
- Ethridge—0 to 4 percent
- Nunemaker—0 to 4 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Ethridge and similar soils: 45 percent
Nunemaker and similar soils: 40 percent

Minor Components
Richey and similar soils: 0 to 4 percent
Scobey and similar soils: 0 to 4 percent
Kevin and similar soils: 0 to 3 percent
Kobase and similar soils: 0 to 3 percent
Nishon and similar soils: 0 to 1 percent

Major Component Description

Ethridge
Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

Nunemaker
Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland

Flooding: None
Available water capacity: Mainly 8.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Evanston Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans and stream terraces
Parent material: Alluvium
Slope range: 0 to 8 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy, mixed Aridic Argiborolls

Typical Pedon

Evanston loam, 0 to 4 percent slopes, in an area of nonirrigated cropland, 2,500 feet south and 900 feet west of the northeast corner of sec. 3, T. 30 N., R. 3 W.

Ap—0 to 5 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky, slightly plastic; common fine roots; many very fine irregular pores; neutral; abrupt smooth boundary.

Bt—5 to 11 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3, rubbed, with 10YR 3/3 coats on faces of peds) moist; moderate medium prismatic parting to moderate fine and medium angular and subangular blocky; hard, friable, moderately sticky, moderately plastic; many very fine and fine roots; many very fine and fine tubular and irregular pores; few distinct clay films; slightly alkaline; clear wavy boundary.

Bk1—11 to 14 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to weak medium subangular blocky; hard, friable, moderately sticky, slightly plastic; common very fine and fine roots; many very fine and fine irregular and tubular pores; common fine soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—14 to 26 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, moderately sticky, slightly plastic; few very fine roots; many very fine and fine irregular pores; many fine soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Bk3—26 to 36 inches; light brownish gray (10YR 6/2) fine sandy loam with thin lenses of clay loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky, nonplastic; 5 percent pebbles; common fine soft masses of lime; strongly effervescent; strongly alkaline; clear wavy boundary.

BC—36 to 60 inches; grayish brown (10YR 5/2) loam with thin lenses of fine sandy loam and silty clay loam, dark grayish brown (10YR 4/2) moist; stratified; hard, friable, moderately sticky, slightly plastic; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 44 to 46 degrees F
Thickness of the mollic epipedon: 7 to 15 inches
Depth to the Bk horizon: 10 to 20 inches

Ap horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 20 to 32 percent
Reaction: pH 6.6 to 7.8

Bt horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 3 to 6 dry; 3 to 5 moist
Chroma: 2 to 4
Texture: Clay loam or loam
Reaction: pH 6.6 to 7.8

Bk horizons
Hue: 2.5Y, 10YR, or 7.5YR
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy clay loam
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

BC horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4
Texture: Loam, clay loam, or sandy clay loam
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 9.0

53B—Evanston loam, 0 to 4 percent slopes

Setting

Landform: Alluvial fans and stream terraces
Slope: 0 to 4 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Evanston and similar soils: 90 percent

Minor Components
Kremlin and similar soils: 0 to 4 percent
Chinook and similar soils: 0 to 2 percent
Telstad and similar soils: 0 to 2 percent
Assinniboine and similar soils: 0 to 1 percent
Floweree and similar soils: 0 to 1 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Fairfield Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 15 to 17 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed Typic Argiborolls

Typical Pedon

Fairfield clay loam, in an area of Kiev-Fairfield complex, 0 to 4 percent slopes, in an area of nonirrigated cropland, 650 feet north and 2,300 feet west of the southeast corner of sec. 17, T. 27 N., R. 6 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; strong medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; common fine roots; few pebbles; neutral; clear smooth boundary.

Bt—6 to 10 inches; grayish brown (10YR 5/2) clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate medium angular blocky; hard, friable, moderately sticky, moderately plastic; common fine roots; common very fine and fine pores; few distinct clay films on vertical faces and patchy on horizontal faces; scattered pebbles; slightly alkaline; clear smooth boundary.

Bk1—10 to 17 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common fine roots; common very fine and fine pores; common fine soft masses of lime; 5 percent lime-coated pebbles; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—17 to 22 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; few fine roots; common very fine and fine pores; many soft masses of lime; 5 percent lime-coated pebbles; violently effervescent; strongly alkaline; gradual wavy boundary.

Bk3—22 to 30 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; few very fine roots; few very fine pores; many soft masses of lime; 10 percent lime-coated pebbles; violently effervescent; strongly alkaline; gradual wavy boundary.

Bk4—30 to 60 inches; light gray (10YR 7/2) loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable, slightly sticky, slightly plastic; many

soft masses of lime; 15 percent lime-coated pebbles; violently effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 10 inches
Other features: Some pedons have a Btk horizon.

Ap horizon
Hue: 10YR or 7.5YR
Value: 3 or 4 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 27 to 32 percent
Content of rock fragments: 0 to 35 percent—0 to 15 percent stones and cobbles; 0 to 20 percent pebbles
Rock fragments, surface cover: 0.01 to 0.1 percent
Reaction: pH 6.6 to 8.4

Bt horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 4 or 5 dry; 3 or 4 moist
Chroma: 2 or 3
Texture: Clay loam, loam, or silty clay loam
Clay content: 30 to 35 percent
Electrical conductivity: 0 to 2 mmhos/cm
Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent pebbles
Reaction: pH 6.6 to 8.4

Bk1 horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Clay loam, loam, or silty clay loam
Clay content: 25 to 35 percent
Content of rock fragments: 0 to 35 percent—0 to 2 percent cobbles; 0 to 15 percent pebbles
Electrical conductivity: 2 to 4 mmhos/cm
Calcium carbonate equivalent: 15 to 35 percent
Reaction: pH 7.4 to 8.4

Bk2, Bk3, and Bk4 horizons
Hue: 2.5Y, 10YR, or 7.5YR
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 to 4
Texture: Clay loam, loam, or silty clay loam
Clay content: 25 to 35 percent
Content of rock fragments: 0 to 35 percent—0 to 15 percent cobbles; 0 to 20 percent pebbles
Calcium carbonate equivalent: 10 to 25 percent
Electrical conductivity: 2 to 4 mmhos/cm
Reaction: pH 7.4 to 9.0

Fairway Series

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Mean annual precipitation: 12 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 120 days

Taxonomic Class: Fine-loamy, mixed Fluvaquentic Haploborolls

Typical Pedon

Fairway loam, in an area of Fairway-Meadowcreek loams, 0 to 2 percent slopes, rarely flooded, in an area of native hayland, 150 feet south and 1,700 feet east of the northwest corner of sec. 13, T. 26 N., R. 8 W.

A1—0 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable, moderately sticky, slightly plastic; many fine roots; many fine irregular pores; weakly effervescent; slightly alkaline; clear smooth boundary.

A2—9 to 15 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium granular structure; hard, friable, moderately sticky, slightly plastic; many very fine and fine roots; common very fine and fine pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Cg1—15 to 24 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; common fine faint yellowish brown (10YR 5/4) redox concentrations; weak fine subangular blocky structure; very hard, firm, moderately sticky, moderately plastic; common very fine and fine roots; common very fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

Cg2—24 to 42 inches; pale brown (10YR 6/3) clay loam, dark grayish brown (10YR 4/2) moist; common fine distinct yellowish brown (10YR 5/4) redox concentrations; massive; very hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; common very fine pores;

strongly effervescent; moderately alkaline; clear wavy boundary.

Cg3—42 to 48 inches; light brownish gray (10YR 6/2) gravelly clay loam, dark grayish brown (10YR 4/2) moist; common fine faint yellowish brown (10YR 5/4) redox concentrations and gray (10YR 5/1) redox depletions; massive; very hard, firm, moderately sticky, moderately plastic; few fine roots in upper part; strongly effervescent; moderately alkaline; clear wavy boundary.

2C—48 to 60 inches; light brownish gray (10YR 6/2) very gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; nonsticky, nonplastic; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 10 to 15 inches
Depth to the 2C horizon: 40 inches or more
Depth to the seasonal high water table: 36 to 60 inches

A1 horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist; 4 or 5 dry
Chroma: 1 or 2
Clay content: 15 to 27 percent
Electrical conductivity: 2 to 8 mmhos/cm
Calcium carbonate equivalent: 2 to 5 percent
Reaction: pH 6.6 to 7.8

A2 horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist; 4 or 5 dry
Chroma: 1 to 3
Texture: Loam, silt loam, clay loam, or silty clay loam
Clay content: 18 to 20 percent
Content of rock fragments: 0 to 15 percent pebbles
Effervescence: Slightly to strongly
Electrical conductivity: 2 to 8 mmhos/cm
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 6.6 to 7.8

Cg horizons
Hue: 10YR or 2.5Y
Value: 3 or 4 moist; 6 dry
Chroma: 1 to 3
Texture: Loam, silt loam, and silty clay loam with some thin strata of sandy loam, loamy sand, and clay loam
Clay content: 20 to 30 percent
Content of rock fragments: 0 to 15 percent pebbles
Effervescence: Slightly to strongly
Calcium carbonate equivalent: 2 to 15 percent
Reaction: pH 6.6 to 7.8

2C horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 3 or 4 moist; 6 dry
Chroma: 1 or 2
Texture: Sand, loamy sand, or sandy loam
Clay content: 0 to 10 percent
Content of rock fragments: 0 to 60 percent—0 to 5 percent cobbles; 0 to 55 percent pebbles
Effervescence: Slightly to strongly
Calcium carbonate equivalent: 0 to 15 percent
Reaction: pH 6.6 to 7.8

125A—Fairway-Meadowcreek loams, 0 to 2 percent slopes, rarely flooded

Setting

Landform:
- Fairway—Flood plains
- Meadowcreek—Flood plains

Slope:
- Fairway—0 to 2 percent
- Meadowcreek—0 to 2 percent

Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 14 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Fairway and similar soils: 50 percent
Meadowcreek and similar soils: 35 percent

Minor Components
Straw and similar soils: 0 to 6 percent
Ridgelawn and similar soils: 0 to 4 percent
Korchea and similar soils: 0 to 3 percent
Tetonview and similar soils: 0 to 2 percent

Major Component Description

Fairway
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Available water capacity: Mainly 10.5 inches

Meadowcreek
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Available water capacity: Mainly 5.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Fifer Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountain slopes
Parent material: Interbedded shale and siltstone
Slope range: 8 to 45 percent
Mean annual precipitation: 18 to 20 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 60 to 90 days

Taxonomic Class: Loamy, mixed, shallow Typic Cryoborolls

Typical Pedon

Fifer clay loam, in an area of Babb-Fifer-Cheadle complex, 8 to 45 percent slopes, in an area of forest land, 2,000 feet south and 300 feet east of the northwest corner of sec. 17, T. 27 N., R. 8 W.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) clay loam, black (10YR 2/1) moist; moderate fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; common fine pores; 10 percent soft shale fragments and 5 percent hard shale fragments; neutral; gradual smooth boundary.

A2—5 to 8 inches; very dark grayish brown (10YR 3/2) clay loam, black (10YR 2/1) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable, moderately sticky, moderately plastic; many very fine and fine roots; many fine and medium pores; 15 percent soft shale fragments and 10 percent hard shale fragments; neutral; gradual wavy boundary.

BC—8 to 13 inches; dark gray (N 4/) channery clay loam, very dark gray (N 3/) moist; moderate thin platy structure; hard, firm, moderately sticky, moderately plastic; many very fine roots between plates; 30 percent soft shale fragments and 20 percent hard shale fragments; slightly alkaline; gradual wavy boundary.

Cr—13 inches; gray (N 5/) interbedded shale and siltstone.

Range in Characteristics

Soil temperature: 39 to 46 degrees F
Thickness of the mollic epipedon: 7 to 10 inches
Depth to the Cr horizon: 10 to 20 inches

A horizons
Hue: 2.5Y or 10YR
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 or 2
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 5 percent pebbles
Reaction: pH 6.6 to 7.8

BC horizon
Hue: 5Y, 2.5Y, 5GY, or N
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 1 or 2
Clay content: 18 to 35 percent
Content of rock fragments: 5 to 15 percent pebbles
Reaction: pH 7.4 to 8.4

Cr horizon
Hue: 5Y, 2.5Y, 5GY, or N
Reaction: pH 7.4 to 8.4

Floweree Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Glaciated till plains and alluvial fans
Parent material: Alluvium and glaciofluvial deposits
Slope range: 0 to 8 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 38 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-silty, mixed Aridic Haploborolls

Typical Pedon

Floweree silt loam, 0 to 4 percent slopes, in an area of nonirrigated cropland, 2,000 feet north and 1,500 feet west of the southeast corner of sec. 22, T. 30 N., R. 3 W.

Ap—0 to 6 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate fine granular structure; soft, very friable, moderately sticky, slightly plastic; common fine and medium roots; slightly effervescent; moderately alkaline; clear smooth boundary.
Bw—6 to 12 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; common fine roots; many very fine tubular pores; slightly effervescent; moderately alkaline; clear smooth boundary.
Bk1—12 to 20 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, moderately sticky, slightly plastic; common very fine tubular roots and few fine; few fine and medium soft masses of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.
Bk2—20 to 36 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak prismatic structure; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; common very fine tubular pores; few threadlike soft masses of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.
BC—36 to 60 inches; pale brown (10YR 6/3) stratified silt loam and silty clay loam, dark brown (10YR 4/3) moist; weak thin platy structure; hard, friable, slightly sticky, slightly plastic; few very fine tubular pores; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 16 inches; may include all or the upper part of the Bw horizon.
Depth to the Bk horizon: 11 to 25 inches

Ap horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist
Chroma: 2 or 3
Texture: Silt loam or silty clay loam
Clay content: 18 to 35 percent
Effervescence: None to strongly
Reaction: pH 6.6 to 8.4

Bw horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 to 4
Texture: Silt loam or silty clay loam
Clay content: 20 to 35 percent
Effervescence: None to strongly
Reaction: pH 7.4 to 8.4

Bk1 horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Silt loam or silty clay loam
Clay content: 20 to 35 percent
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 8.4

Bk2 horizon
Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Silt loam or silty clay loam
Clay content: 20 to 35 percent
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 7.9 to 8.4

BC horizon
Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Silty clay loam or loam consisting of thin strata of silt loam, very fine sandy loam, and/or clay loam
Clay content: 20 to 35 percent
Calcium carbonate equivalent: 5 to 15 percent
Gypsum: 0 to 2 percent
Electrical conductivity: 0 to 4 mmhos/cm
Sodium adsorption ratio: 1 to 5
Reaction: pH 7.9 to 9.0

58B—Floweree silt loam, 0 to 4 percent slopes

Setting

Landform: Till plains
Slope: 0 to 4 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Floweree and similar soils: 90 percent

Minor Components
Lonna and similar soils: 0 to 7 percent
Kremlin and similar soils: 0 to 3 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

458B—Floweree silty clay loam, 0 to 4 percent slopes

Setting

Landform: Till plains
Slope: 0 to 4 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Floweree and similar soils: 90 percent

Minor Components
Lonna and similar soils: 0 to 4 percent
Ethridge and similar soils: 0 to 3 percent
Richey and similar soils: 0 to 3 percent

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Gallatin Series

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Permeability: Slow
Landform: Mountains
Parent material: Alluvium
Slope range: 0 to 8 percent
Mean annual precipitation: 19 to 22 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 60 to 90 days

Taxonomic Class: Fine-loamy, mixed Pachic Cryoborolls

Typical Pedon

Gallatin loam, in an area of Adel-Gallatin-Shedhorn complex, 0 to 8 percent slopes, in an area of native hayland, 500 feet south and 2,400 feet west of the northeast corner of sec. 4, T. 24 N., R. 8 W.

A1—0 to 4 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; moderate medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, nonsticky, slightly plastic; many very fine and common roots; few fine vesicular pores; neutral; clear smooth boundary.

A2—4 to 14 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; moderate medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; common fine vesicular pores; neutral; gradual wavy boundary.

A3—14 to 23 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and coarse subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few very fine roots; common fine vesicular pores; slightly alkaline; gradual wavy boundary.

Bw—23 to 28 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; few fine faint yellowish brown (10YR 5/6) redox concentrations; moderate fine and coarse subangular blocky structure; hard, friable, moderately sticky, moderately plastic; few very fine roots; few fine vesicular pores; slightly alkaline; gradual wavy boundary.

Bk—28 to 36 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; many medium distinct light olive brown (2.5Y 5/4) redox concentrations; massive; very hard, firm,

moderately sticky, moderately plastic; common medium soft masses of lime; strongly effervescent; slightly alkaline; gradual wavy boundary.

Bkg—36 to 60 inches; light gray (5Y 6/1) and (5Y 7/1) gravelly clay loam, dark gray (5Y 5/1) and (5Y 6/1) moist; many medium prominent olive yellow (2.5Y 6/6) redox concentrations; massive; extremely hard, firm, moderately sticky, moderately plastic; common medium soft masses of lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Thickness of the mollic epipedon: 16 to 30 inches
Depth to the seasonal high water table: 24 to 48 inches

A1 and A2 horizons
Hue: 10YR or 2.5Y
Value: 3 or 4 dry; 2 or 3 moist
Chroma: 1 or 2
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 15 percent pebbles
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 7.0 to 7.6

A3 horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 1 or 2
Texture: Sandy clay loam, loam, or clay loam
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 15 percent pebbles
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 7.0 to 7.6

Bw horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 2 or 3
Texture: Sandy clay loam, loam, or clay loam
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 15 percent pebbles
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 7.2 to 7.8

Bk horizon
Hue: 2.5Y or 10YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Sandy clay loam or clay loam
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 15 percent pebbles
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 7.4 to 8.4

Bkg horizon
Hue: 5Y, 2.5Y, or 10YR
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 1 or 2
Texture: Loam, clay loam, or sandy clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 0 to 20 percent pebbles
Reaction: pH 7.4 to 8.4

Garlet Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountain slopes
Parent material: Colluvium and alpine till
Slope range: 8 to 60 percent
Mean annual precipitation: 20 to 24 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 50 to 90 days

Taxonomic Class: Loamy-skeletal, mixed Typic Cryochrepts

Typical Pedon

Garlet stony loam, in an area of Garlet-Cheadle-Loberg stony loams, 8 to 45 percent slopes, in an area of forest land, 900 feet south and 900 feet west of the northeast corner of sec. 8, T. 23 N., R. 8 W.

O—1 inch to 0; undecomposed and slightly decomposed forest litter.

E1—0 to 3 inches; grayish brown (10YR 5/2) stony loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, nonsticky, nonplastic; many fine and few coarse roots; many fine vesicular pores; 20 percent stones, cobbles, and pebbles; moderately acid; clear smooth boundary.

E2—3 to 12 inches; brown (10YR 5/3) stony loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common fine and few coarse roots; common fine vesicular pores; 20 percent stones, cobbles, and pebbles; slightly acid; clear wavy boundary.

E/Bw—12 to 28 inches; 60 percent brown (10YR 5/3) and 40 percent pale brown (10YR 6/3) very

cobbly loam, dark brown (10YR 4/3) and brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common fine and few coarse roots; common fine vesicular pores; 40 percent stones, cobbles, and pebbles; neutral; gradual wavy boundary.

C1—28 to 50 inches; pale brown (10YR 6/3) very cobbly loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few coarse roots; few fine vesicular pores; 30 percent stones and cobbles and 20 percent pebbles; neutral; gradual wavy boundary.

C2—50 to 60 inches; pale brown (10YR 6/3) extremely cobbly loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky, nonplastic; few coarse roots; 40 percent pebbles and 30 percents stones and cobbles; neutral.

Range in Characteristics

Soil temperature: 38 to 47 degrees F

E1 horizon
Hue: 10YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 1 to 3
Clay content: 10 to 25 percent
Content of rock fragments: 15 to 60 percent—0 to 30 percent stones and cobbles; 5 to 45 percent pebbles
Reaction: pH 5.6 to 6.5

E2 horizon
Hue: 10YR or 7.5YR
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or sandy loam
Clay content: 10 to 25 percent
Content of rock fragments: 35 to 85 percent—10 to 40 percent stones and cobbles; 25 to 60 percent pebbles
Reaction: pH 5.6 to 6.5

E/Bw horizon
Hue: E part—10YR or 7.5YR; B part—10YR or 7.5YR
Value: E part—5 or 6 dry; 4 or 5 moist; B part—6 or 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Sandy clay loam, sandy loam, or loam
Clay content: 10 to 25 percent
Content of rock fragments: 40 to 80 percent—15 to 40 percent stones and cobbles; 25 to 60 percent pebbles
Reaction: pH 5.6 to 6.5

C horizons
Hue: 7.5YR, 10YR, or 2.5Y
Value: 6 or 7 dry; 5 or 6 moist
Chroma: 2 to 4
Texture: Loam, sandy loam, or sandy clay loam
Clay content: 5 to 25 percent
Content of rock fragments: 45 to 80 percent—15 to 30 percent stones and cobbles; 30 to 50 percent pebbles
Calcium carbonate equivalent: 0 to 10 percent
Reaction: pH 5.6 to 8.4

493E—Garlet-Cheadle-Loberg stony loams, 8 to 45 percent slopes

Setting

Landform:
- Garlet—Mountains
- Cheadle—Mountains
- Loberg—Mountains

Position on landform:
- Garlet—Backslopes and shoulders
- Cheadle—Shoulders and summits
- Loberg—Backslopes and footslopes

Slope:
- Garlet—25 to 45 percent
- Cheadle—8 to 45 percent
- Loberg—8 to 35 percent

Elevation: 5,000 to 6,300 feet
Mean annual precipitation: 20 to 24 inches
Frost-free period: 60 to 90 days

Composition

Major Components
Garlet and similar soils: 35 percent
Cheadle and similar soils: 25 percent
Loberg and similar soils: 25 percent

Minor Components
Areas of rock outcrop: 0 to 8 percent
Fifer and similar soils: 0 to 5 percent
Tibson and similar soils: 0 to 2 percent

Major Component Description

Garlet
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 5.3 inches

Cheadle
Surface layer texture: Stony loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 1.6 inches

Loberg
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 5.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Gerdrum Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Very slow
Landform: Stream terraces and alluvial fans
Parent material: Alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic Typic Natriboralfs

Typical Pedon

Gerdrum clay loam, in an area of Gerdrum-Absher clay loams, 0 to 2 percent slopes, in an area of rangeland, 1,100 feet north and 700 feet west of the southeast corner of sec. 20, T. 23 N., R. 1 W.

E—0 to 3 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; common unstained silt and sand grains; slightly alkaline; abrupt smooth boundary.

Btn1—3 to 7 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong medium columnar structure parting to moderate fine and medium subangular blocky; extremely hard, very firm, moderately sticky, very plastic; common very fine and fine roots; few fine tubular pores; few coats of unstained sand and silt grains on tops of columns; common distinct clay films on faces of peds; slightly alkaline; clear smooth boundary.

Btn2—7 to 15 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; extremely hard, very firm, moderately sticky, very plastic; common fine roots; few very fine tubular pores; common distinct clay films on faces of peds; slightly alkaline; clear wavy boundary.

Btnk—15 to 25 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, moderately sticky, very plastic; few very fine roots; few very fine tubular pores; few faint clay films on faces of peds; common fine soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bknyz—25 to 36 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, moderately sticky, moderately plastic; few very fine roots; few very fine tubular pores; common fine and medium soft masses of gypsum and other salts; common fine soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bnyz—36 to 60 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, firm, very sticky, very plastic; few very fine pores; common fine and medium soft seams of gypsum and other salts; weakly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Btnk horizon: 10 to 24 inches
Depth to gypsum: 10 to 28 inches

E horizon
Hue: 10YR or 2.5Y
Value: 6 or 7 dry; 4 to 6 moist
Chroma: 2 or 3
Clay content: 20 to 27 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.6 to 7.8

Btn1 horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay, silty clay, or silty clay loam
Clay content: 35 to 55 percent
Content of rock fragments: 0 to 10 percent pebbles
Hardness: Extremely or very hard when dry
Electrical conductivity: 1 to 8 mmhos/cm
Sodium adsorption ratio: 10 to 20
Reaction: pH 7.4 to 9.0

Btn2 horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay, silty clay, or silty clay loam
Clay content: 35 to 55 percent
Content of rock fragments: 0 to 10 percent pebbles
Hardness: Extremely or very hard when dry
Electrical conductivity: 1 to 8 mmhos/cm
Sodium adsorption ratio: 10 to 20
Reaction: pH 7.4 to 9.0

Btnk horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Clay, silty clay, silty clay loam, or clay loam
Clay content: 35 to 50 percent
Content of rock fragments: 0 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 2 to 8 mmhos/cm
Sodium adsorption ratio: 13 to 20
Reaction: pH 7.4 to 9.0

Bknyz and Bnyz horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Silty clay loam, clay loam, sandy clay loam, clay, or silty clay
Clay content: 35 to 50 percent
Content of rock fragments: 0 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 8 to 16 mmhos/cm
Sodium adsorption ratio: 13 to 30
Gypsum: 1 to 5 percent
Reaction: pH 7.9 to 9.0

114A—Gerdrum-Absher clay loams, 0 to 2 percent slopes

Setting

Landform:
- Gerdrum—Alluvial fans and stream terraces
- Absher—Alluvial fans and stream terraces

Position on landform:
- Gerdrum—Microhighs
- Absher—Microlows

Slope:
- Gerdrum—0 to 2 percent
- Absher—0 to 2 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Gerdrum and similar soils: 50 percent
Absher and similar soils: 35 percent

Minor Components
Creed and similar soils: 0 to 8 percent
Marvan and similar soils: 0 to 5 percent
McKenzie and similar soils: 0 to 2 percent

Major Component Description

Gerdrum
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.1 inches

Absher
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 4.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Hanson Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Stream terraces and hills
Parent material: Alluvium derived from limestone and argillite
Slope range: 0 to 35 percent
Mean annual precipitation: 18 to 20 inches
Annual air temperature: 38 to 41 degrees F
Frost-free period: 60 to 90 days

Taxonomic Class: Loamy skeletal, carbonatic Calcic Cryoborolls

Typical Pedon

Hanson very cobbly loam, in an area of Hanson-Raynesford complex, 0 to 4 percent slopes, in an area of rangeland, 2,600 feet south and 1,250 feet west of the northeast corner of sec. 11, T. 27 N., R. 9 W.

A—0 to 6 inches; grayish brown (10YR 4/2) very cobbly loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; 20 percent limestone pebbles, 15 percent cobbles, and 5 percent stones; neutral; clear smooth boundary.

Bk1—6 to 10 inches; grayish brown (10YR 5/2) very cobbly loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; 20 percent limestone pebbles and 10 percent cobbles; common fine and medium soft masses of lime; strongly effervescent; slightly alkaline; gradual wavy boundary.

2Bk2—10 to 18 inches; light brownish gray (10YR 6/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; moderate fine subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; 35 percent limestone pebbles and 10 percent cobbles; many fine and medium soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

2C—18 to 60 inches; light gray (10YR 7/2) extremely gravelly loam, brown (10YR 5/3) moist; massive structure; slightly hard, very friable, slightly sticky, nonplastic; few very fine roots; 60 percent limestone pebbles and 10 percent cobbles; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 37 to 44 degrees F
Thickness of the mollic epipedon: 8 to 16 inches
Depth to the calcic horizon: 8 to 16 inches

A horizon
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 or 2
Clay content: 15 to 27 percent
Content of rock fragments: 5 to 50 percent—0 to 25 percent stones and cobbles; 5 to 45 percent pebbles or channers
Surface stones, cover: 0 to 0.1 percent
Reaction: pH 6.6 to 7.8

Bk1 horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 to 8 dry; 3 to 6 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 18 to 32 percent
Content of rock fragments: 35 to 80 percent—20 to 55 percent stones and cobbles; 15 to 25 percent pebbles or channers
Calcium carbonate equivalent: 30 to 40 percent in less than 2-mm particle-size fraction; more than 40 percent in the less than 20-mm particle-size fraction
Reaction: pH 7.4 to 8.4

2Bk2 and 2C horizons
Hue: 7.5YR, 10YR, or 2.5Y
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 18 to 32 percent
Content of rock fragments: 35 to 90 percent—10 to 30 percent stones and cobbles; 25 to 60 percent pebbles or channers
Calcium carbonate equivalent: 15 to 30 percent in the less than 2-mm particle-size fraction; more than 40 percent in the less than 20-mm fraction
Reaction: pH 7.4 to 8.4

195B—Hanson-Raynesford complex, 0 to 4 percent slopes

Setting

Landform:
- Hanson—Stream terraces
- Raynesford—Stream terraces

Slope:
- Hanson—0 to 4 percent
- Raynesford—0 to 4 percent

Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 18 to 20 inches
Frost-free period: 60 to 90 days

Composition

Major Components
Hanson and similar soils: 50 percent
Raynesford and similar soils: 35 percent

Minor Components
Shedhorn and similar soils: 0 to 8 percent
Sebud and similar soils: 0 to 6 percent
Gallatin and similar soils: 0 to 1 percent

Major Component Description

Hanson
Surface layer texture: Very cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.7 inches

Raynesford
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

495B—Hanson very cobbly loam, 0 to 4 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 4 percent
Elevation: 4,600 to 5,600 feet
Mean annual precipitation: 18 to 20 inches
Frost-free period: 60 to 90 days

Composition

Major Components
Hanson and similar soils: 85 percent

Minor Components
Raynesford and similar soils: 0 to 8 percent
Tibson and similar soils: 0 to 5 percent
Shedhorn and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Very cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 4.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

403—Haploborolls-Argiborolls complex, 0 to 4 percent slopes, rarely flooded

Setting

Landform:
- Haploborolls—Alluvial fans
- Argiborolls—Alluvial fans

Slope:
- Haploborolls—0 to 4 percent
- Argiborolls—0 to 4 percent

Elevation: 3,300 to 4,600 feet
Mean annual precipitation: 12 to 19 inches
Frost-free period: 90 to 120 days

Composition

Major Components
Haploborolls and similar soils: 45 percent
Argiborolls and similar soils: 40 percent

Minor Components
Lardell and similar soils: 0 to 5 percent
Ethridge and similar soils: 0 to 2 percent
Kevin and similar soils: 0 to 2 percent
Kremlin and similar soils: 0 to 2 percent
Richey and similar soils: 0 to 2 percent
Scobey and similar soils: 0 to 2 percent

Major Component Description

Haploborolls
Dominant parent material: Alluvium
Flooding: Rare

Argiborolls
Dominant parent material: Glaciofluvial deposits
Flooding: Rare

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Harlake Series

Depth class: Very deep (more than 60 inches)
Permeability: Slow
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 95 to 125 days

Taxonomic Class: Fine, montmorillonitic (calcareous), frigid Aridic Ustifluvents

Typical Pedon

Harlake clay loam, 0 to 4 percent slopes, rarely flooded, in an area of nonirrigated cropland, 250 feet south and 2,500 feet west of the northeast corner of sec. 17, T. 23 N., R. 5 W.

A—0 to 5 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium granular structure; slightly hard, friable, moderately sticky, moderately plastic; many fine and few medium roots; strongly effervescent; moderately alkaline; clear smooth boundary.

C—5 to 15 inches; light brownish gray (10YR 6/2) silty clay loam, brown (10YR 4/3) moist; moderate medium granular structure; hard, firm, moderately sticky, moderately plastic; many fine roots; common fine pores; violently effervescent; moderately alkaline; gradual wavy boundary.

Cz—15 to 60 inches; pale brown (10YR 6/3) silty clay loam consisting of thin strata of silt loam and clay, brown (10YR 5/3) moist; massive; hard, firm, moderately sticky, moderately plastic; many fine and few very fine roots; few fine pores; common fine masses of salts; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Other features: Some pedons have a thin dark-colored surface about 4-inches thick that has values of 4 or 5 dry; 3 moist, and chroma of 2 or 3.

A horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 30 to 40 percent
Electrical conductivity: 0 to 2 mmhos/cm
Sodium adsorption ratio: 0 to 4
Calcium carbonate equivalent: 0 to 5 percent
Effervescence: Slightly or strongly
Reaction: pH 6.6 to 8.4

C horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Clay, silty clay, or silty clay loam consisting of stratified layers of clay, silt loam, silty clay loam, and silty clay
Clay content: 35 to 55 percent
Electrical conductivity: 0 to 4 mmhos/cm
Sodium adsorption ratio: 0 to 5
Calcium carbonate equivalent: 2 to 10 percent
Effervescence: Slightly or violently
Reaction: pH 7.4 to 9.0

Cz horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Silt loam, loam, clay loam, or fine sandy loam consisting of stratified layers of silty clay loam, silt loam, and fine sandy loam

Clay content: 15 to 35 percent
Electrical conductivity: 8 to 16 mmhos/cm
Sodium adsorption ratio: 0 to 13
Calcium carbonate equivalent: 2 to 10 percent
Effervescence: Strongly or violently
Reaction: pH 7.9 to 9.0

406—Harlake clay loam, 0 to 4 percent slopes, rarely flooded

Setting

Landform: Flood plains
Slope: 0 to 4 percent
Elevation: 3,300 to 4,600 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 95 to 125 days

Composition

Major Components
Harlake and similar soils: 85 percent

Minor Components
Havre and similar soils: 0 to 6 percent
Harlake, poorly drained: 0 to 5 percent
Ryell and similar soils: 0 to 4 percent

Major Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Salt affected: Saline within 30 inches
Available water capacity: Mainly 6.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Havre Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 90 to 125 days

Taxonomic Class: Fine-loamy, mixed (calcareous), frigid Aridic Ustifluvents

Typical Pedon

Havre loam, in an area of Havre-Ryell loams, 0 to 2 percent slopes, rarely flooded, in an area of nonirrigated cropland, 1,300 feet south and 600 feet west of the northeast corner of sec. 14, T. 24 N., R. 5 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium roots; strongly effervescent; moderately alkaline; clear wavy boundary.
C1—8 to 20 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; common fine and medium pores; strongly effervescent; moderately alkaline; gradual wavy boundary.
C2—20 to 60 inches; light brownish gray (10YR 6/2) loam consisting of thin strata of clay loam, fine sandy loam, and silt loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, slightly sticky, slightly plastic; few very fine roots in upper part; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F

Ap horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 15 to 27 percent
Calcium carbonate equivalent: 1 to 10 percent
Electrical conductivity: 0 to 2 mmhos/cm
Sodium adsorption ratio: 0 to 4
Reaction: pH 7.4 to 8.4

C1 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam, silt loam, or clay loam consisting of strata of silt loam, fine sandy loam, silty clay loam, and clay loam
Clay content: 18 to 35 percent
Calcium carbonate equivalent: 1 to 10 percent
Effervescence: Slightly or strongly

Electrical conductivity: 0 to 4 mmhos/cm
Sodium adsorption ratio: 0 to 5
Reaction: pH 7.4 to 9.0

C2 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam, silt loam, or clay loam consisting of strata of silt loam, fine sandy loam, silty clay loam, and clay loam
Clay content: 18 to 35 percent
Calcium carbonate equivalent: 1 to 10 percent
Effervescence: Slightly or strongly
Electrical conductivity: 0 to 4 mmhos/cm
Sodium adsorption ratio: 0 to 5
Reaction: pH 7.4 to 9.0

7A—Havre loam, 0 to 2 percent slopes, rarely flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Havre and similar soils: 85 percent

Minor Components
Poorly drained soils: 0 to 5 percent
Harlake and similar soils: 0 to 4 percent
Rivra and similar soils: 0 to 3 percent
Ryell and similar soils: 0 to 3 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 9.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

107A—Havre-Ryell loams, 0 to 2 percent slopes, rarely flooded

Setting

Landform:
- Havre—Flood plains
- Ryell—Flood plains

Slope:
- Havre—0 to 2 percent
- Ryell—0 to 2 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Havre and similar soils: 55 percent
Ryell and similar soils: 35 percent

Minor Components
Areas of riverwash: 0 to 5 percent
Rivra and similar soils: 0 to 3 percent
Fairway and similar soils: 0 to 2 percent

Major Component Description

Havre
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 9.8 inches

Ryell
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 5.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

400—Havre-Fairway loams, 0 to 4 percent slopes, rarely flooded

Setting

Landform:
- Havre—Flood plains
- Fairway—Flood plains

Slope:
- Havre—0 to 4 percent
- Fairway—0 to 2 percent

Elevation: 3,200 to 4,600 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 90 to 120 days

Composition

Major Components
Havre and similar soils: 45 percent
Fairway and similar soils: 40 percent

Minor Components
Meadowcreek and similar soils: 0 to 5 percent
Ryell and similar soils: 0 to 3 percent
Tetonview and similar soils: 0 to 3 percent
Rivra and similar soils: 0 to 2 percent
Birchfield and similar soils: 0 to 2 percent

Major Component Description

Havre
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 9.8 inches

Fairway
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Available water capacity: Mainly 8.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Hillon Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Glaciated till plains and hills
Parent material: Glacial till
Slope range: 2 to 60 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy, mixed (calcareous), frigid Aridic Ustorthents

Typical Pedon

Hillon clay loam, in an area of Delpoint-Cabbart-Hillon complex, 25 to 60 percent slopes, in an area of rangeland, 1,600 feet south and 500 feet west of the northeast corner of sec. 17, T. 29 N., R. 3 W.

A—0 to 5 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, moderately sticky, slightly plastic; common fine and medium roots; many fine irregular pores; 5 percent pebbles; slightly effervescent; moderately alkaline; abrupt smooth boundary.

Bk1—5 to 32 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, moderately sticky, moderately plastic; common fine roots; many fine tubular pores; common soft masses of lime; 5 percent pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—32 to 45 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, very sticky, very plastic; few very fine roots; many very fine and fine tubular pores; common soft masses of lime; 5 percent pebbles; strongly effervescent; strongly alkaline; gradual smooth boundary.

Cy—45 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark brownish gray (2.5Y 4/2) moist; massive; hard, firm, very sticky, very plastic; few very fine roots; common very fine tubular pores; few fine seams and threadlike masses of

gypsum; few lignite chips; 10 percent pebbles; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Depth to accumulated carbonates: 3 to 9 inches
Moist bulk density of till: 1.55 to 1.75 g/cm^3
Other features: When mixed to 7 inches, the surface layer will not meet the color requirements for a mollic epipedon.

A horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 3 to 5 moist
Chroma: 2 or 3
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 25 percent—0 to 10 percent stones and cobbles; 0 to 15 percent pebbles
Calcium carbonate equivalent: 0 to 10 percent
Effervescence: None to violently
Reaction: pH 7.4 to 8.4

Bk horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 20 to 35 percent with 25 to 35 percent fine and coarser sand
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Effervescence: Strongly or violently
Moist bulk density: 1.55 to 1.75 g/cm^3
Reaction: pH 7.9 to 9.0

Cy horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 20 to 35 percent with 25 to 35 percent fine and coarser sand
Content of rock fragments: 0 to 15 percent pebbles
Moist bulk density: 1.55 to 1.75 g/cm^3
Calcium carbonate equivalent: 2 to 15 percent
Effervescence: Strongly to violently
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 7.9 to 9.0

61F—Hillon clay loam, 15 to 60 percent slopes

Setting

Landform: Hills
Slope: 15 to 60 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 125 days

Composition

Major Components
Hillon and similar soils: 85 percent

Minor Components
Kevin and similar soils: 0 to 6 percent
Joplin and similar soils: 0 to 3 percent
Yawdim and similar soils: 0 to 3 percent
Abor and similar soils: 0 to 2 percent
Kobase and similar soils: 0 to 1 percent

Major Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

161F—Hillon-Yawdim complex, 15 to 45 percent slopes

Setting

Landform:
- Hillon—Hills
- Yawdim—Hills

Position on landform:
- Hillon—Backslopes and footslopes
- Yawdim—Backslopes and shoulders

Slope:
- Hillon—15 to 45 percent
- Yawdim—15 to 45 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Hillon and similar soils: 50 percent
Yawdim and similar soils: 35 percent

Minor Components
Kevin and similar soils: 0 to 5 percent
Abor and similar soils: 0 to 4 percent
Kobase and similar soils: 0 to 3 percent
Megonot and similar soils: 0 to 3 percent

Major Component Description

Hillon
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

Yawdim
Surface layer texture: Silty clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

163D—Hillon-Kevin clay loams, 8 to 15 percent slopes

Setting

Landform:
- Hillon—Hills
- Kevin—Hills

Position on landform:
- Hillon—Shoulders
- Kevin—Backslopes and footslopes

Slope:
- Hillon—8 to 15 percent
- Kevin—8 to 15 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Hillon and similar soils: 45 percent
Kevin and similar soils: 40 percent

Minor Components
Scobey and similar soils: 0 to 9 percent
Yawdim and similar soils: 0 to 4 percent
Ethridge and similar soils: 0 to 2 percent

Major Component Description

Hillon
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

Kevin
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

257E—Hillon-Lambeth complex, 15 to 35 percent slopes

Setting

Landform:
- Hillon—Hills
- Lambeth—Hills

Position on landform:
- Hillon—Backslopes and footslopes
- Lambeth—Shoulders and summits

Slope:
- Hillon—15 to 35 percent
- Lambeth—15 to 35 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Hillon and similar soils: 45 percent
Lambeth and similar soils: 45 percent

Minor Components
Kevin and similar soils: 0 to 5 percent
Lonna and similar soils: 0 to 5 percent

Major Component Description

Hillon
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

Lambeth
Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 11.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Joplin Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Glaciated till plains
Parent material: Glacial till
Slope range: 0 to 8 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy, mixed Aridic Argiborolls

Typical Pedon

Joplin loam, in an area of Telstad-Joplin loams, 4 to 8 percent slopes, in an area of nonirrigated cropland, 1,750 feet south and 150 feet east of the northwest corner of sec. 17, T. 26 N., R. 3 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse granular structure; slightly hard, friable, slightly sticky, slightly plastic; common fine roots; neutral; clear smooth boundary.

Bt—6 to 9 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium angular and subangular blocky; hard, friable, moderately sticky, moderately plastic; common fine roots; common very fine and fine tubular pores; few distinct clay films; slightly alkaline; clear smooth boundary.

Btk—9 to 18 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, moderately sticky, slightly plastic; common very fine roots; many very fine and fine pores; few faint clay films; common fine and medium soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk—18 to 33 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure; hard, friable, moderately sticky, slightly plastic; few very fine roots; common very fine and fine irregular pores; common fine and medium soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

BC—33 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, moderately sticky, slightly plastic; few soft masses of lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 10 inches
Depth to secondary lime: 7 to 10 inches
Other features: Some pedons have a Bky horizon.

Ap horizon
Hue: 10YR or 2.5Y
Chroma: 2 or 3
Clay content: 10 to 27 percent
Content of rock fragments: 0 to 60 percent—0 to 40 percent cobbles; 5 to 20 percent pebbles
Effervescence: None to violently
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 6.6 to 7.8

Bt horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 3 or 4 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 25 to 35 percent
Content of rock fragments: 0 to 15 percent pebbles
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 6.6 to 7.8

Btk and Bk horizons
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 18 to 32 percent
Content of rock fragments: 0 to 35 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Gypsum: 0 to 5 percent
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 7.4 to 8.4

BC horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 18 to 32 percent
Content of rock fragments: 0 to 35 percent pebbles
Moist bulk density: 1.6 to 1.8 g/cm^3
Gypsum: 0 to 5 percent
Electrical conductivity: 2 to 8 mmhos/cm
Reaction: pH 7.4 to 8.4

Judith Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to 24 inches; moderately rapid below this depth
Landform: Stream terraces
Parent material: Alluvium
Slope range: 0 to 8 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, carbonatic Typic Calciborolls

Typical Pedon

Judith loam, in an area of Judith-Windham complex, 0 to 4 percent slopes, in an area of rangeland, 700 feet north and 1,850 feet east of the southwest corner of sec. 28, T. 26 N., R. 7 W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many fine roots; many fine irregular pores; 5 percent pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw—5 to 10 inches; grayish brown (10YR 5/2) clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak fine subangular blocky; hard, friable, slightly sticky, slightly plastic; many fine roots; many very fine and fine pores; 5 percent pebbles with lime coats on undersides; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk1—10 to 14 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium

prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, slightly sticky, moderately plastic; common very fine and fine roots; common fine distinct soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—14 to 24 inches; light gray (10YR 7/2) gravelly clay loam, pale brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky, moderately plastic; few very fine and fine roots; common very fine pores; 20 percent pebbles; lime coats on undersides of larger pebbles; many fine and medium soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

2Bk3—24 to 38 inches; pale brown (10YR 6/3) very gravelly loam, pale brown (10YR 5/3) moist; massive; hard, friable, slightly sticky, moderately plastic; few very fine and fine roots; 50 percent pebbles and 10 percent cobbles; lime coats on pebbles with lime crusts on undersides of larger pebbles; violently effervescent; moderately alkaline; gradual wavy boundary.

2Bk4—38 to 60 inches; pale brown (10YR 6/3) extremely gravelly sandy clay loam, pale brown (10YR 5/3) moist; massive; hard, friable, slightly sticky, slightly plastic; 60 percent pebbles and 10 percent cobbles; lime coats on pebbles with lime crusts on undersides of larger pebbles; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 41 to 46 degrees F
Thickness of the mollic epipedon: 7 to 12 inches
Depth to the calcic horizon: 9 to 12 inches
Depth to the 2Bk3 horizon: Mainly 23 to 32 inches but ranges from 23 to 38 inches

A horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 1 to 3
Clay content: 18 to 27 percent
Content of rock fragments: 5 to 35 percent—0 to 10 percent cobbles; 5 to 25 percent pebbles
Reaction: pH 7.4 to 8.4

Bw horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 or 6 dry; 3 or 4 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 5 to 35 percent—0 to 10 percent cobbles; 5 to 25 percent pebbles
Reaction: pH 7.9 to 8.4

Bk horizons
Hue: 7.5YR, 10YR, or 2.5Y
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 18 to 35 percent (10 to 20 percent noncarbonate clay)
Content of rock fragments: 5 to 35 percent—0 to 10 percent cobbles; 5 to 25 percent pebbles
Calcium carbonate content: 40 to 60 percent
Reaction: pH 7.9 to 8.4

2Bk horizons
Hue: 7.5YR, 10YR, or 2.5Y
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy clay loam
Clay content: 20 to 35 percent (10 to 20 percent noncarbonate clay)
Content of rock fragments: 35 to 80 percent—10 to 20 percent cobbles; 25 to 60 percent pebbles
Calcium carbonate content: 40 to 60 percent
Reaction: pH 7.9 to 9.0

20B—Judith loam, 0 to 4 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 4 percent
Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Judith and similar soils: 85 percent

Minor Components
Windham and similar soils: 0 to 6 percent
Kiev and similar soils: 0 to 5 percent
Utica and similar soils: 0 to 3 percent
Arrod and similar soils: 0 to 1 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium

Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

120B—Judith-Kiev loams, 0 to 4 percent slopes

Setting

Landform:
- Judith—Stream terraces
- Kiev—Stream terraces

Slope:
- Judith—0 to 4 percent
- Kiev—0 to 4 percent

Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Judith and similar soils: 45 percent
Kiev and similar soils: 45 percent

Minor Components
Windham and similar soils: 0 to 7 percent
Arrod and similar soils: 0 to 3 percent

Major Component Description

Judith
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.2 inches

Kiev
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

120C—Judith-Kiev loams, 4 to 8 percent slopes

Setting

Landform:
- Judith—Stream terraces
- Kiev—Stream terraces

Slope:
- Judith—4 to 8 percent
- Kiev—4 to 8 percent

Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Judith and similar soils: 45 percent
Kiev and similar soils: 45 percent

Minor Components
Windham and similar soils: 0 to 5 percent
Roundor and similar soils: 0 to 3 percent
Arrod and similar soils: 0 to 2 percent

Major Component Description

Judith
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.2 inches

Kiev
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland

Flooding: None
Available water capacity: Mainly 10.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

220B—Judith-Windham complex, 0 to 4 percent slopes

Setting

Landform:
• Judith—Stream terraces
• Windham—Stream terraces
Slope:
• Judith—0 to 4 percent
• Windham—0 to 4 percent
Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Judith and similar soils: 50 percent
Windham and similar soils: 40 percent

Minor Components
Utica and similar soils: 0 to 4 percent
Kiev and similar soils: 0 to 3 percent
Shawmut and similar soils: 0 to 3 percent

Major Component Description

Judith
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.0 inches

Windham
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

220C—Judith-Windham complex, 4 to 8 percent slopes

Setting

Landform:
• Judith—Stream terraces
• Windham—Stream terraces
Slope:
• Judith—4 to 8 percent
• Windham—4 to 8 percent
Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Judith and similar soils: 50 percent
Windham and similar soils: 40 percent

Minor Components
Utica and similar soils: 0 to 4 percent
Kiev and similar soils: 0 to 3 percent
Shawmut and similar soils: 0 to 3 percent

Major Component Description

Judith
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.0 inches

Windham
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland

Flooding: None
Available water capacity: Mainly 3.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

620C—Judith-Windham cobbly loams, 0 to 8 percent slopes

Setting

Landform:
• Judith—Stream terraces
• Windham—Stream terraces
Slope:
• Judith—0 to 8 percent
• Windham—0 to 8 percent
Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Judith and similar soils: 45 percent
Windham and similar soils: 40 percent

Minor Components
Shawmut and similar soils: 0 to 7 percent
Kiev and similar soils: 0 to 4 percent
Utica and similar soils: 0 to 4 percent

Major Component Description

Judith
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.8 inches

Windham
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Kevin Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Glaciated till plains and hills
Parent material: Glacial till
Slope range: 0 to 15 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy, mixed Aridic Argiborolls

Typical Pedon

Kevin clay loam, in an area of Scobey-Kevin clay loams, 4 to 8 percent slopes, in an area of nonirrigated cropland, 1,500 feet north and 200 feet east of the southwest corner of sec. 9, T. 25 N., R. 2 W.

Ap—0 to 6 inches; brown (10YR 5/3) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; hard, friable, moderately sticky, moderately plastic; many fine and few medium roots; many very fine pores; few pebbles; neutral; clear smooth boundary.

Bt—6 to 9 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, moderately sticky, moderately plastic; many very fine and fine roots; many very fine and fine tubular pores; few pebbles; common distinct clay films on peds; neutral; clear wavy boundary.

Bk1—9 to 14 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; many very fine and fine tubular pores; few fine soft masses of lime; few pebbles; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—14 to 34 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure; very hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; few very fine tubular and irregular pores; many fine and medium soft masses of lime; few pebbles; violently effervescent; moderately alkaline; gradual wavy boundary.

Bky—34 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, friable, moderately sticky, moderately plastic; few fine soft masses of lime; common fine and medium threadlike masses of gypsum in cracks; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 10 inches
Depth to the Bk horizon: 7 to 10 inches
Moist bulk density of till: 1.6 to 1.8 g/cm^3

Ap horizon
Hue: 10YR, 2.5Y, or 5Y
Chroma: 2 or 3
Clay content: 27 to 32 percent
Content of rock fragments: 0 to 60 percent—0 to 10 percent cobbles; 0 to 50 percent pebbles
Reaction: pH 6.6 to 7.8

Bt horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 or 5 dry; 3 or 4 moist
Chroma: 2 or 3
Texture: Clay loam or clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.6 to 8.4

Bk horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 15 percent pebbles
Moist bulk density: 1.55 to 1.75 g/cm^3
Calcium carbonate equivalent: .5 to 15 percent pebbles
Reaction: pH 7.4 to 8.4

Bky horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 15 percent pebbles
Moist bulk density: 1.55 to 1.75 g/cm^3
Calcium carbonate equivalent: 2 to 10 percent
Gypsum: 1 to 4 percent
Reaction: pH 7.9 to 8.4

163C—Kevin-Hillon clay loams, 2 to 8 percent slopes

Setting

Landform:
- Kevin—Till plains
- Hillon—Till plains

Position on landform:
- Kevin—Footslopes
- Hillon—Shoulders

Slope:
- Kevin—2 to 8 percent
- Hillon—2 to 8 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Kevin and similar soils: 45 percent
Hillon and similar soils: 40 percent

Minor Components
Scobey and similar soils: 0 to 8 percent
Ethridge and similar soils: 0 to 3 percent
Kobase and similar soils: 0 to 2 percent
McKenzie and similar soils: 0 to 1 percent
Nishon soils: 0 to 1 percent

Major Component Description

Kevin
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.2 inches

Hillon
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till

Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Kiev Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Stream terraces and hills
Parent material: Alluvium
Slope range: 0 to 35 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed Typic Calciborolls

Typical Pedon

Kiev loam, in an area of Kiev-Roundor loams, 2 to 15 percent slopes, in an area of rangeland, 2,600 feet south and 400 feet east of the northwest corner of sec. 19, T. 28 N., R. 7 W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure in the upper part grading to moderate medium granular in the lower part; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many vesicular pores; 5 percent pebbles; neutral; clear smooth boundary.

Bw—5 to 14 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; common very fine and fine pores; 5 percent pebbles; slightly effervescent; slightly alkaline; clear wavy boundary.

Bk1—14 to 28 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; common very fine and fine pores; few pebbles; strongly effervescent; common fine soft masses of lime; moderately alkaline; gradual wavy boundary.

Bk2—28 to 60 inches; light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; moderate fine and medium subangular blocky structure; hard, friable, moderately sticky, slightly plastic; few very fine and fine roots; common very fine pores; violently effervescent; common medium soft masses of lime; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to the calcic horizon: 7 to 18 inches

A horizon
Hue: 5Y, 2.5Y, 10YR, or 7.5YR
Value: 3 or 4 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 35 percent—0 to 20 percent stones and cobbles; 0 to 15 percent pebbles
Effervescence: Slightly to strongly
Reaction: pH 7.4 to 7.8

Bw horizon
Hue: 5Y, 2.5Y, 10YR, or 7.5YR
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 or 3
Texture: Loam, clay loam, or silt loam
Clay content: 18 to 30 percent
Content of rock fragments: 0 to 25 percent—0 to 10 percent cobbles; 0 to 15 percent pebbles
Effervescence: Slightly to violently
Reaction: pH 7.4 to 8.4

Bk horizons
Hue: 5Y, 2.5Y, 10YR, or 7.5YR
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, silt loam, or clay loam
Clay content: 18 to 30 percent
Content of rock fragments: 0 to 25 percent—0 to 10 percent cobbles; 0 to 15 percent pebbles
Calcium carbonate equivalent: 15 to 30 percent
Effervescence: Strongly or violently
Reaction: pH 7.4 to 8.4

117B—Kiev-Fairfield complex, 0 to 4 percent slopes

Setting

Landform:
- Kiev—Stream terraces
- Fairfield—Stream terraces

Slope:
- Kiev—0 to 4 percent
- Fairfield—0 to 4 percent

Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 17 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Kiev and similar soils: 50 percent
Fairfield and similar soils: 40 percent

Minor Components
Judith and similar soils: 0 to 10 percent

Major Component Description

Kiev
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.3 inches

Fairfield
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

121B—Kiev-Judith gravelly loams, 0 to 4 percent slopes

Setting

Landform:
- Kiev—Stream terraces
- Judith—Stream terraces

Slope:
- Kiev—0 to 4 percent
- Judith—0 to 4 percent

Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Kiev and similar soils: 50 percent
Judith and similar soils: 45 percent

Minor Components
Windham and similar soils: 0 to 3 percent
Arrod and similar soils: 0 to 1 percent
Fairfield and similar soils: 0 to 1 percent

Major Component Description

Kiev
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.0 inches

Judith
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

184D—Kiev-Roundor loams, 2 to 15 percent slopes

Setting

Landform:
• Kiev—Hills
• Roundor—Hills
Position on landform:
• Kiev—Footslopes
• Roundor—Backslopes and footslopes
Slope:
• Kiev—2 to 15 percent
• Roundor—2 to 15 percent
Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Kiev and similar soils: 50 percent
Roundor and similar soils: 35 percent

Minor Components
Amor and similar soils: 0 to 8 percent
Cabbart and similar soils: 0 to 5 percent
Judith and similar soils: 0 to 2 percent

Major Component Description

Kiev
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.3 inches

Roundor
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

284D—Kiev-Roundor gravelly loams, 2 to 15 percent slopes

Setting

Landform:
• Kiev—Hills
• Roundor—Hills
Position on landform:
• Kiev—Footslopes
• Roundor—Backslopes and footslopes
Slope:
• Kiev—2 to 15 percent
• Roundor—2 to 15 percent
Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Kiev and similar soils: 45 percent
Roundor and similar soils: 40 percent

Minor Components
Cabbart and similar soils: 0 to 7 percent
Judith and similar soils: 0 to 4 percent
Windham and similar soils: 0 to 4 percent

Major Component Description

Kiev
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.0 inches

Roundor
Surface layer texture: Gravelly loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland

Flooding: None
Available water capacity: Mainly 5.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

475F—Kiev-Roundor-Windham complex, 15 to 45 percent slopes

Setting

Landform:
- Kiev—Hills
- Roundor—Hills
- Windham—Hills

Position on landform:
- Kiev—Backslopes and footslopes
- Roundor—Backslopes
- Windham—Risers

Slope:
- Kiev—15 to 35 percent
- Roundor—15 to 45 percent
- Windham—25 to 45 percent

Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Kiev and similar soils: 40 percent
Roundor and similar soils: 30 percent
Windham and similar soils: 15 percent

Minor Components
Amor and similar soils: 0 to 7 percent
Cabbart and similar soils: 0 to 4 percent
Judith and similar soils: 0 to 4 percent

Major Component Description

Kiev
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.3 inches

Roundor
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.3 inches

Windham
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

784C—Kiev-Winifred-Vanda complex, 0 to 15 percent slopes

Setting

Landform:
- Kiev—Hills
- Winifred—Hills
- Vanda—Alluvial fans

Position on landform:
- Kiev—Footslopes
- Winifred—Backslopes and footslopes

Slope:
- Kiev—0 to 15 percent
- Winifred—0 to 15 percent
- Vanda—0 to 15 percent

Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 17 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Kiev and similar soils: 40 percent
Winifred and similar soils: 25 percent
Vanda and similar soils: 20 percent

Minor Components
Linwell and similar soils: 0 to 7 percent
Amor and similar soils: 0 to 4 percent
Roundor and similar soils: 0 to 3 percent
McKenzie and similar soils: 0 to 1 percent

Major Component Description

Kiev
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.2 inches

Winifred
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.9 inches

Vanda
Surface layer texture: Clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Kobase Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Alluvial fans and glaciated till plains
Parent material: Alluvium
Slope range: 0 to 15 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic, frigid Aridic Ustochrepts

Typical Pedon

Kobase silty clay loam, 0 to 4 percent slopes, in an area of nonirrigated cropland, 2,000 feet north and 500 feet west of the southeast corner of sec. 30, T. 25 N., R. 3 W.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium granular structure; slightly hard, very friable, moderately sticky, moderately plastic; common fine and medium roots; 5 percent pebbles; many fine irregular pores; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw1—6 to 14 inches; olive (5Y 5/3) silty clay, olive (5Y 4/3) moist; weak medium prismatic structure parting to moderate fine and medium angular blocky; very hard, firm, moderately sticky, moderately plastic; common very fine and fine roots; common fine tubular pores; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw2—14 to 24 inches; olive (5Y 5/3) clay, olive (5Y 4/3) moist; moderate medium prismatic structure parting to moderate medium angular and subangular blocky; very fine roots; common very fine and fine pores; few pressure faces; slightly effervescent; moderately alkaline; gradual wavy boundary.

Bk—24 to 28 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; very hard, firm, moderately sticky, moderately plastic; few very fine and fine roots; common very fine and fine pores; few fine soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bky—28 to 36 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; very hard, firm, moderately sticky, moderately plastic; few very fine roots; few fine soft masses of lime; common fine and medium threads of gypsum crystals; strongly effervescent; moderately alkaline; clear wavy boundary.

By—36 to 60 inches; mixed color of pale yellow (2.5Y 7/4) and light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4) moist; massive; very hard, firm, very

sticky, very plastic; 5 percent pebbles; common fine masses and seams of gypsum crystals; few soft chips of lignite; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Bk horizon: 12 to 17 inches
Depth to the Bky horizon: 20 to 40 inches
Soil phases: Moist
Other features: Some pedons have a C horizon. The 1 chromas are lithochromic in the B horizons. Some pedons have thin strata of silt loam or loam below depths of 40 inches and a BCy or Byz horizon.

Ap horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Silty clay loam or clay loam
Clay content: 27 to 40 percent
Content of rock fragments: 0 to 5 percent pebbles
Electrical conductivity: 0 to 2 mmhos/cm
Calcium carbonate equivalent: 0 to 5 percent
Reaction: pH 7.4 to 8.4

Bw horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 1 to 4
Texture: Silty clay loam, silty clay, or clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 5 percent pebbles
Calcium carbonate equivalent: 0 to 10 percent
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 7.4 to 8.4

Bk horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 1 to 4
Texture: Silty clay loam, silty clay, or clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 5 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Sodium adsorption ratio: 0 to 10
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 7.4 to 9.0

Bky horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Silty clay loam, silty clay, or clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 5 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Sodium adsorption ratio: 0 to 10
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 7.9 to 9.0

By horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 1 to 4
Texture: Silty clay loam, silty clay, or clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 5 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Sodium adsorption ratio: 1 to 20
Electrical conductivity: 0 to 8 mmhos/cm
Gypsum: 1 to 5 percent
Reaction: pH 7.9 to 9.0

40B—Kobase silty clay loam, 0 to 4 percent slopes

Setting

Landform: Alluvial fans
Slope: 0 to 4 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Kobase and similar soils: 90 percent

Minor Components
Ethridge and similar soils: 0 to 4 percent
Marias and similar soils: 0 to 4 percent
Abor and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 9.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

40C—Kobase silty clay loam, 4 to 8 percent slopes

Setting

Landform: Alluvial fans
Slope: 4 to 8 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Kobase and similar soils: 90 percent

Minor Components
Ethridge and similar soils: 0 to 5 percent
Marias and similar soils: 0 to 3 percent
Abor and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 9.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

240B—Kobase-Marias complex, 0 to 4 percent slopes

Setting

Landform:
- Kobase—Till plains
- Marias—Till plains

Slope:
- Kobase—0 to 4 percent
- Marias—0 to 4 percent

Elevation: 3,200 to 3,800 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Kobase and similar soils: 55 percent
Marias and similar soils: 35 percent

Minor Components
Linnet and similar soils: 0 to 4 percent
Ethridge and similar soils: 0 to 3 percent
Nishon soils: 0 to 2 percent
Richey and similar soils: 0 to 1 percent

Major Component Description

Kobase
Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 9.7 inches

Marias
Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

541C—Kobase-Ethridge clay loams, 4 to 8 percent slopes

Setting

Landform:
- Kobase—Alluvial fans
- Ethridge—Alluvial fans

Position on landform:
- Kobase—Backslopes and footslopes
- Ethridge—Footslopes

Slope:
- Kobase—4 to 8 percent
- Ethridge—4 to 8 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Kobase and similar soils: 50 percent
Ethridge and similar soils: 35 percent

Minor Components
Linnet and similar soils: 0 to 6 percent
Marias and similar soils: 0 to 5 percent
Richey and similar soils: 0 to 4 percent

Major Component Description

Kobase
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 9.6 inches

Ethridge
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Korchea Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed (calcareous) frigid Mollic Ustifluvents

Typical Pedon

Korchea loam, in an area of Korchea-Ridgelawn loams, 0 to 2 percent slopes, rarely flooded, in an area of irrigated grass-hay meadowland, 2,100 feet south and 2,000 feet west of the northeast corner of sec. 29, T. 23 N., R. 6 W.

A—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, very friable, slightly sticky, nonplastic; many roots; many vesicular pores; slightly effervescent; moderately alkaline; clear smooth boundary.

C1—8 to 16 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; stratified; weak fine and medium granular structure in individual strata; soft, very friable, slightly sticky, nonplastic; many fine roots; common vesicular pores; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—16 to 29 inches; grayish brown (10YR 5/2) loam with thin lenses of fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, slightly sticky, nonplastic; common very fine roots; common vesicular pores; strongly effervescent; slightly alkaline; clear wavy boundary.

C3—29 to 48 inches; grayish brown (10YR 5/2) fine sandy loam with thin lenses of loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, slightly sticky, nonplastic; few very fine roots; common vesicular pores; strongly effervescent; slightly alkaline; clear wavy boundary.

C4—48 to 60 inches; grayish brown (10YR 5/2) loam with few fine faint yellowish brown (10YR 5/4) mottles; massive; soft, very friable, slightly sticky, nonplastic; strongly effervescent; slightly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Other features: Some pedons have layers of coarser or finer textures at depths of 40 to 60 inches.

A horizon
Hue: 10YR or 2.5Y
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 2 or 3

Clay content: 18 to 27 percent
Reaction: pH 6.6 to 8.4

C horizons
Hue: 2.5Y or 10YR
Value: 4 to 7 dry; 3 to 6 moist
Chroma: 2 to 4
Texture: Loam, silt loam, fine sandy loam, sandy loam, or very fine sandy loam
Clay content: 18 to 27 percent
Reaction: pH 7.4 to 8.4

108A—Korchea-Ridgelawn loams, 0 to 2 percent slopes, rarely flooded

Setting

Landform:
- Korchea—Flood plains
- Ridgelawn—Flood plains

Slope:
- Korchea—0 to 2 percent
- Ridgelawn—0 to 2 percent

Elevation: 3,800 to 4,400 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Korchea and similar soils: 50 percent
Ridgelawn and similar soils: 35 percent

Minor Components
Korchea and similar soils: 0 to 5 percent
Nesda and similar soils: 0 to 5 percent
Straw and similar soils: 0 to 5 percent

Major Component Description

Korchea
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 10.1 inches

Ridgelawn
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 7.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

208A—Korchea-Straw loams, 0 to 2 percent slopes, rarely flooded

Setting

Landform:
- Korchea—Flood plains
- Straw—Flood plains

Slope:
- Korchea—0 to 2 percent
- Straw—0 to 2 percent

Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Korchea and similar soils: 50 percent
Straw and similar soils: 35 percent

Minor Components
Tetonview and similar soils: 0 to 5 percent
Fairway and similar soils: 0 to 4 percent
Ridgelawn and similar soils: 0 to 4 percent
Nesda and similar soils: 0 to 2 percent

Major Component Description

Korchea
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 10.1 inches

Straw
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland

Flooding: Rare
Available water capacity: Mainly 10.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Kremlin Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans, stream terraces, hills, and sedimentary plains
Parent material: Alluvium
Slope range: 0 to 15 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy, mixed Aridic Haploborolls

Typical Pedon

Kremlin loam, 0 to 4 percent slopes, in an area of nonirrigated cropland, 300 feet south and 500 feet east of the northwest corner of sec. 12, T. 29 N., R. 2 W.

Ap—0 to 6 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, slightly sticky, nonplastic; common fine roots; neutral; clear smooth boundary.

Bw—6 to 12 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to weak medium subangular blocky; hard, friable, moderately sticky, slightly plastic; slightly effervescent; neutral; clear smooth boundary.

Bk1—12 to 18 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, very friable, moderately sticky, slightly plastic; common very fine and fine roots; many very fine and fine pores; common fine soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—18 to 26 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak medium and coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky, slightly plastic; few very fine and fine roots; common very fine and fine pores; few fine soft masses of lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk3—26 to 42 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure; slightly hard, very friable, moderately sticky, slightly plastic; few very fine roots; few very fine pores; few fine soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

BC—42 to 60 inches; pale brown (10YR 6/3) stratified loam and silt loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, moderately sticky, slightly plastic; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 15 inches; may includes all or the upper part of the Bw horizon.
Depth to the Bk horizon: 10 to 24 inches
Soil phases: Calcareous

Ap horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 5 percent pebbles
Effervescence: None to strongly
Calcium carbonate equivalent: 5 to 15 percent for the calcareous phase
Reaction: pH 6.1 to 8.4; calcareous phase is pH 7.4 to 8.4

Bw horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 or 3
Texture: Loam, silt loam, clay loam, or sandy clay loam
Clay content: 18 to 30 percent
Content of rock fragments: 0 to 5 percent pebbles
Effervescence: Slightly to strongly
Calcium carbonate equivalent: 5 to 15 percent for the calcareous phase
Reaction: pH 6.6 to 8.4; calcareous phase is pH 7.9 to 8.4

Bk horizons
- Hue: 10YR or 2.5Y
- Value: 5 to 7 dry; 4 to 6 moist
- Chroma: 2 or 3
- Texture: Loam, silt loam, clay loam, or sandy clay loam
- Clay content: 18 to 30 percent
- Content of rock fragments: 0 to 5 percent pebbles
- Calcium carbonate equivalent: 5 to 15 percent
- Effervescence: Strongly or violently
- Electrical conductivity: 0 to 2 mmhos/cm
- Reaction: pH 7.4 to 8.4; calcareous phase is pH 7.9 to 9.0

BC horizon
- Hue: 10YR, 2.5Y, or 5Y
- Value: 6 to 8 dry; 4 to 6 moist
- Chroma: 2 to 4
- Clay content: 10 to 25 percent
- Content of rock fragments: 0 to 5 percent pebbles
- Calcium carbonate equivalent: 3 to 12 percent
- Effervescence: Strongly or violently
- Electrical conductivity: 0 to 4 mmhos/cm
- Reaction: pH 7.4 to 9.0; calcareous phase pH 7.9 to 9.0

22B—Kremlin loam, 0 to 4 percent slopes

Setting

Landform: Alluvial fans
Slope: 0 to 4 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Kremlin and similar soils: 85 percent

Minor Components
Yamacall and similar soils: 0 to 5 percent
Evanston and similar soils: 0 to 4 percent
Chinook and similar soils: 0 to 3 percent
Joplin and similar soils: 0 to 3 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

322B—Kremlin clay loam, 0 to 4 percent slopes

Setting

Landform: Alluvial fans
Slope: 0 to 4 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Kremlin and similar soils: 90 percent

Minor Components
Ethridge and similar soils: 0 to 4 percent
Richey and similar soils: 0 to 3 percent
Kobase and similar soils: 0 to 2 percent
Rothiemay and similar soils: 0 to 1 percent

Major Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

322C—Kremlin clay loam, 4 to 8 percent slopes

Setting

Landform: Alluvial fans
Slope: 4 to 8 percent
Elevation: 3,200 to 4,200 feet

Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Kremlin and similar soils: 90 percent

Minor Components
Richey and similar soils: 0 to 5 percent
Ethridge and similar soils: 0 to 3 percent
Rothiemay and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

522C—Kremlin-Delpoint clay loams, 2 to 8 percent slopes

Setting

Landform:
- Kremlin—Sedimentary plains
- Delpoint—Sedimentary plains

Position on landform:
- Kremlin—Footslopes
- Delpoint—Backslopes and shoulders

Slope:
- Kremlin—2 to 8 percent
- Delpoint—2 to 8 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Kremlin and similar soils: 50 percent
Delpoint and similar soils: 35 percent

Minor Components
Evanston and similar soils: 0 to 3 percent
Megonot and similar soils: 0 to 3 percent
Richey and similar soils: 0 to 3 percent
Yamacall and similar soils: 0 to 3 percent
Kobase and similar soils: 0 to 2 percent
Cabbart and similar soils: 0 to 1 percent

Major Component Description

Kremlin
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

Delpoint
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Lambeth Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Hills
Parent material: Alluvium
Slope range: 15 to 70 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-silty, mixed (calcareous), frigid Aridic Ustorthents

Typical Pedon

Lambeth silt loam, in an area of Hillon-Lambeth complex, 15 to 35 percent slopes, in an area of rangeland, 550 feet south and 900 feet west of the northeast corner of sec. 16, T. 30 N., R. 3 W.

A—0 to 4 inches; light brownish gray (10YR 6/2) silt loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, moderately sticky, slightly plastic; common fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—4 to 13 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak medium granular; slightly hard, very friable, moderately sticky, slightly plastic; common very fine and fine roots; many very fine and fine pores; few very fine threads of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—13 to 25 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak medium granular; hard, very friable, moderately sticky, slightly plastic; common very fine and fine roots; common very fine and fine pores; few very fine threads of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C—25 to 44 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; hard, very friable, moderately sticky, slightly plastic; few very fine and fine roots; few fine pores; violently effervescent; moderately alkaline; gradual wavy boundary.

Cy—44 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; hard, very friable, moderately sticky, slightly plastic; strongly effervescent; few very fine threads of gypsum; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

A horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Clay content: 20 to 27 percent
Calcium carbonate equivalent: 5 to 10 percent
Effervescence: Slightly to violently
Reaction: pH 7.4 to 8.4

Bk horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Silt loam or silty clay loam with thin bands of loam, fine sandy loam, or very fine sandy loam
Clay content: 20 to 35 percent
Gypsum: 1 to 5 percent
Calcium carbonate equivalent: 5 to 15 percent
Effervescence: Strongly or violently
Reaction: pH 7.9 to 9.0

C and Cy horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Silt loam or silty clay loam with thin bands of loam, fine sandy loam, or very fine sandy loam
Clay content: 20 to 35 percent
Gypsum: 1 to 5 percent
Calcium carbonate equivalent: 5 to 15 percent
Effervescence: Strongly or violently
Reaction: pH 7.9 to 9.0

Lardell Series

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Permeability: Slow
Landform: Fan terraces and glaciated till plains
Parent material: Alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy, mixed, frigid Aquollic Salorthids

Typical Pedon

Lardell silty clay loam, 0 to 4 percent slopes, in an area of rangeland, 300 feet north and 1,700 feet west of the southeast corner of sec. 21, T. 24 N., R. 3 W.

Az—0 to 6 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; very hard, friable, moderately sticky, moderately plastic; few very fine roots; common fine masses of salts; slightly effervescent; very strongly alkaline; clear smooth boundary.

Bz1—6 to 18 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine subangular blocky structure; extremely hard, firm, moderately sticky, very plastic; few very fine roots; common very fine tubular pores;

many fine masses of salts when dry; slightly effervescent; very strongly alkaline; clear wavy boundary.

Bz2—18 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, firm, moderately sticky, moderately plastic; few very fine tubular pores; many fine masses of salt when dry; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the salic horizon: 4 to 8 inches
Depth to the seasonal high water table: 18 to 36 inches

Az horizon
Hue: 10YR, 2.5Y, 5Y, or N
Value: 4 to 6 moist; 5 to 7 dry
Chroma: 1 or 2
Clay content: 27 to 40 percent
Electrical conductivity: Greater than 16 mmhos/cm
Sodium adsorption ratio: 8 to 50
Reaction: pH 7.9 to 10.0

Bz1 horizon
Hue: 10YR, 2.5Y, 5Y, or N
Value: 4 to 6 moist; 5 to 7 dry
Chroma: 1 to 3
Texture: Silty clay loam, silt loam, loam, or clay loam
Clay content: 27 to 35 percent
Electrical conductivity: Greater than 16 to 50 mmhos/cm
Salt content: 2 to 3 percent
Sodium adsorption ratio: 13 to 80
Reaction: pH 8.5 to 10.0

Bz2 horizon
Hue: 10YR, 2.5Y, 5Y, or N
Value: 4 to 6 moist; 5 to 7 dry
Chroma: 1 to 4
Texture: Silty clay loam, silt loam, loam, or clay loam
Clay content: 15 to 35 percent
Electrical conductivity: 16 to 50 mmhos/cm
Salt content: 1 to 2 percent
Sodium adsorption ratio: 13 to 30
Reaction: pH 8.5 to 10.0

3B—Lardell silty clay loam, 0 to 4 percent slopes

Setting

Landform: Till plains
Slope: 0 to 4 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Lardell and similar soils: 90 percent

Minor Components
McKenzie and similar soils: 0 to 3 percent
Absher and similar soils: 0 to 2 percent
Gerdrum and similar soils: 0 to 2 percent
Nishon and similar soils: 0 to 2 percent
Vanda and similar soils: 0 to 1 percent

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Apparent
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 4.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Linnet Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Very slow
Landform: Glaciated till plains and sedimentary plains

Parent material: Alluvium
Slope range: 0 to 8 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic Ustertic Argiborolls

Typical Pedon

Linnet silty clay, in an area of Marias-Linnet silty clays, 0 to 4 percent slopes, in an area of nonirrigated cropland, 30 feet north and 300 feet west of the southeast corner of sec. 3, T. 29 N., R. 5 W.

Ap—0 to 5 inches; dark grayish brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; strong very fine and fine granular structure; hard, friable, moderately sticky, very plastic; common fine roots; many fine irregular pores; neutral; clear smooth boundary.

Bt—5 to 13 inches; dark grayish brown (2.5Y 4/2) silty clay, dark grayish brown (2.5Y 4/2) moist; ped faces on vertical cracks very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to strong fine angular blocky; extremely hard, firm, moderately sticky, very plastic; common very fine and fine roots; common very fine tubular and few fine pores; common distinct clay films on faces of peds; 3/4- to 1-inch wide cracks; neutral; clear smooth boundary.

Bk1—13 to 26 inches; olive gray (5Y 4/2) silty clay, olive gray (5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; extremely hard, firm, moderately sticky, very plastic; common very fine and fine roots; common very fine tubular pores; few fine soft masses of lime; strongly effervescent; slightly alkaline; clear wavy boundary.

Bk2—26 to 48 inches; olive (5Y 5/3) silty clay, olive (5Y 4/3) moist; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; extremely hard, firm, moderately sticky, very plastic; few very fine and fine roots; common very fine and fine pores; few fine soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

BCy—48 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, firm, moderately sticky, very plastic; few fine soft masses and threads of gypsum crystals; 5 percent pebbles; few fine weathered lignite chips; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Surface cracks: 1- to 2-inches wide
Depth to the Bk horizon: 11 to 20 inches

Ap horizon
Hue: 10YR or 2.5Y
Chroma: 2 or 3
Clay content: 40 to 45 percent
Content of rock fragments: 0 to 10 percent pebbles
Reaction: pH 6.1 to 7.3

Bt horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 4 or 5 moist
Chroma: 2 to 4
Clay content: 45 to 60 percent
Texture: Clay loam, silty clay loam, clay, or silty clay
Content of rock fragments: 0 to 10 percent pebbles
Reaction: pH 6.6 to 7.8

Bk horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Clay, silty clay, or silty clay loam
Clay content: 35 to 50 percent
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Sodium adsorption ratio: 0 to 13
Reaction: pH 7.4 to 9.0

BCy horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Clay, silty clay, clay loam, or silty clay loam
Clay content: 35 to 50 percent
Content of rock fragments: 0 to 15 percent pebbles
Gypsum: 2 to 5 percent
Sodium adsorption ratio: 2 to 13
Reaction: pH 7.9 to 9.0

147C—Linnet-Abor silty clays, 2 to 8 percent slopes

Setting

Landform:
- Linnet—Sedimentary plains
- Abor—Sedimentary plains

Position on landform:
- Linnet—Footslopes
- Abor—Backslopes and shoulders

Slope:
- Linnet—2 to 8 percent
- Abor—2 to 8 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Linnet and similar soils: 50 percent
Abor and similar soils: 35 percent

Minor Components
Marias and similar soils: 0 to 8 percent
Lothair and similar soils: 0 to 4 percent
Ethridge and similar soils: 0 to 3 percent

Major Component Description

Linnet
Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.8 inches

Abor
Surface layer texture: Silty clay
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Linwell Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Hills
Parent material: Alluvium
Slope range: 2 to 15 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Fine, montmorillonitic Typic Haploborolls

Typical Pedon

Linwell clay loam, in an area of Linwell-Winifred clay loams, 2 to 15 percent slopes, in an area of rangeland, 400 feet south and 2,100 feet east of the northwest corner of sec. 8, T. 26 N., R. 7 W.

A—0 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable, moderately sticky, moderately plastic; many fine roots; many fine irregular pores; slightly effervescent in spots; slightly alkaline; clear smooth boundary.

Bw—7 to 15 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, moderately sticky, moderately plastic; many fine roots; common very fine and fine pores; slightly effervescent; slightly alkaline; clear smooth boundary.

Bk1—15 to 23 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; very hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; common very fine and fine pores; common medium soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—23 to 36 inches; light brownish gray (5Y 6/2) silty clay loam, grayish brown (5Y 5/2) moist; weak medium subangular blocky structure; very hard, firm, very sticky, very plastic; few very fine and fine roots; common very fine pores; few fine and medium soft masses of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

C—36 to 60 inches; light brownish gray (5Y 6/2) silty clay loam, grayish brown (5Y 5/2) moist; massive;

very hard, firm, very sticky, very plastic; few very fine pores; few fine threads of gypsum in upper few inches; effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to the Bk horizon: 12 to 24 inches

A horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist
Chroma: 1 or 2
Clay content: 30 to 40 percent
Content of rock fragments: 0 to 5 percent pebbles
Reaction: pH 6.6 to 7.8

Bw horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Silty clay loam, clay loam, or silty clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 10 percent pebbles
Reaction: pH 7.4 to 8.4

Bk horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Silty clay loam, clay loam, or silty clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

C horizon
Hue: 7.5YR, 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4
Mottles: None to few
Texture: Silty clay loam, clay loam, or silty clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 12 percent
Reaction: pH 7.9 to 8.4

179C—Linwell-Winifred clay loams, 2 to 15 percent slopes

Setting

Landform:
- Linwell—Hills
- Winifred—Hills

Position on landform:
- Linwell—Footslopes
- Winifred—Backslopes and shoulders

Slope:
- Linwell—2 to 15 percent
- Winifred—2 to 15 percent

Elevation: 3,400 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Linwell and similar soils: 50 percent
Winifred and similar soils: 35 percent

Minor Components
Wayden and similar soils: 0 to 7 percent
Amor and similar soils: 0 to 4 percent
Cabba and similar soils: 0 to 4 percent

Major Component Description

Linwell
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.9 inches

Winifred
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Loberg Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Mountain slopes
Parent material: Colluvium
Slope range: 8 to 35 percent
Mean annual precipitation: 20 to 24 inches
Annual air temperature: 38 to 41 degrees F
Frost-free period: 50 to 90 days

Taxonomic Class: Clayey-skeletal, mixed Glossic Cryoboralfs

Typical Pedon

Loberg stony loam, in an area of Loberg-Whitore-Garlet stony loams, 8 to 35 percent slopes, in an area of forest land, 800 feet south and 1,700 feet west of the northeast corner of sec. 30, T. 25 N., R. 8 W.

O—1 inch to 0; undecomposed and slightly decomposed forest litter.

E—0 to 8 inches; light brownish gray (10YR 6/2) stony loam, dark grayish brown (10YR 4/2) moist; moderate medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; common very fine vesicular pores; 20 percent stones; slightly acid; gradual wavy boundary.

E/Bt—8 to 24 inches; 70 percent light brownish gray (10YR 6/2) and 30 percent brown (10YR 5/3) very channery clay loam, dark grayish brown (10YR 4/2) and dark brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure; slightly hard, firm, slightly sticky, moderately plastic; common very fine roots; common very fine and fine tubular pores; 35 percent sandstone fragments; neutral; diffuse irregular boundary.

Bt—24 to 60 inches; brown (10YR 5/3) very channery clay loam, dark brown (10YR 4/3) moist; tonguing of light brownish gray (10YR 6/2) loam in upper 8 inches; strong medium prismatic structure parting to strong medium subangular blocky; hard, firm, moderately sticky, moderately plastic; few very fine roots; common fine tubular pores; many distinct clay films on faces of prisms, faces of peds, and lining tubular pores; 45 percent sandstone fragments and 5 percent stones; neutral.

Range in Characteristics

Soil temperature: 36 to 47 degrees F
Other features: Some pedons have a thin 1- to 4-inch thick A horizon.

E horizon
Hue: 7.5YR, 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 3 to 5 moist
Chroma: 2 or 3
Clay content: 20 to 27 percent
Surface stones, cover: 0 to 3 percent
Content of rock fragments: 15 to 75 percent—0 to 70 percent stones and cobbles; 10 to 35 percent pebbles
Reaction: pH 5.1 to 6.5

E/Bt horizon
Hue: 7.5YR, 10YR, 2.5Y, or 5Y
Value: E part—5 to 7 dry; 3 to 5 moist; Bt part—4 to 6 dry; 3 to 5 moist
Chroma: 2 or 3
Clay content: 35 to 50 percent
Content of rock fragments: 20 to 60 percent—15 to 45 percent stones and cobbles; 10 to 40 percent pebbles
Reaction: pH 5.1 to 6.5

Bt horizon
Hue: 7.5YR, 10YR, 2.5Y, or 5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 or 3
Texture: Sandy clay, clay, or clay loam
Clay content: 35 to 45 percent
Content of rock fragments: 35 to 60 percent—0 to 45 percent stones and cobbles; 20 to 40 percent pebbles
Reaction: pH 6.1 to 7.8

193E—Loberg-Whitore-Garlet stony loams, 8 to 35 percent slopes

Setting

Landform:
- Loberg—Mountains
- Whitore—Mountains
- Garlet—Mountains

Position on landform:
- Loberg—Backslopes and footslopes
- Whitore—Shoulders and summits
- Garlet—Backslopes and shoulders

Slope:
- Loberg—8 to 35 percent
- Whitore—8 to 35 percent
- Garlet—8 to 35 percent

Elevation: 5,000 to 6,300 feet
Mean annual precipitation: 20 to 24 inches
Frost-free period: 50 to 80 days

Composition

Major Components
Loberg and similar soils: 35 percent
Whitore and similar soils: 25 percent
Garlet and similar soils: 25 percent

Minor Components
Cheadle and similar soils: 0 to 9 percent
Tibson and similar soils: 0 to 6 percent

Major Component Description

Loberg
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 5.1 inches

Whitore
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 4.5 inches

Garlet
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 5.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Lonna Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans
Parent material: Glaciofluvial deposits
Slope range: 2 to 8 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-silty, mixed, frigid Aridic Ustochrepts

Typical Pedon

Lonna silt loam, in an area of Lonna-Floweree silt loams, 2 to 8 percent slopes, in an area of rangeland, 1,000 feet south and 650 feet west of the northeast corner of sec. 16, T. 30 N., R. 3 W.

A—0 to 3 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, moderately sticky, slightly plastic; many fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw—3 to 11 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, moderately sticky, slightly plastic; many very fine and fine roots; many very fine and fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk1—11 to 25 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, very friable, moderately sticky, slightly plastic; common very fine and fine roots; many very fine and fine pores; common very fine threads of soft lime; strongly effervescent; strongly alkaline; clear wavy boundary.

Bk2—25 to 42 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; hard, very friable, moderately sticky, slightly plastic; few very fine and fine roots; common very fine and fine pores; common fine threads of soft lime;

strongly effervescent; strongly alkaline; gradual wavy boundary.

BCy—42 to 60 inches; pale brown (10YR 6/3) silt loam with thin lenses of silty clay loam, brown (10YR 5/3) moist; massive; hard, very friable, moderately sticky, slightly plastic; common fine threads of gypsum; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Bk horizon: 10 to 12 inches

A horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 3 to 5 moist
Chroma: 2 to 4
Clay content: 18 to 27 percent
Effervescence: Slightly or strongly
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bw horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Silt loam or silty clay loam
Clay content: 18 to 35 percent
Effervescence: Slightly or strongly
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bk1 horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Silt loam or silty clay loam
Clay content: 18 to 35 percent
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 2 to 8 mmhos/cm
Sodium adsorption ratio: 0 to 13
Effervescence: Strongly or violently
Reaction: pH 7.9 to 8.4

Bk2 horizon
Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 4 to 7 moist
Chroma: 2 to 4
Texture: Silt loam or silty clay loam
Clay content: 18 to 35 percent
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 2 to 8 mmhos/cm
Sodium adsorption ratio: 0 to 13
Effervescence: Strongly or violently
Reaction: pH 7.9 to 8.4

BCy horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Very fine sandy loam, loam, silt loam, or silty clay loam (may be stratified)
Clay content: 10 to 35 percent
Electrical conductivity: 2 to 16 mmhos/cm
Sodium adsorption ratio: 10 to 20
Effervescence: Strongly or violently
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 9.0

158C—Lonna-Floweree silt loams, 2 to 8 percent slopes

Setting

Landform:
• Lonna—Alluvial fans
• Floweree—Alluvial fans
Position on landform:
• Lonna—Shoulders
• Floweree—Footslopes
Slope:
• Lonna—2 to 8 percent
• Floweree—2 to 8 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Lonna and similar soils: 45 percent
Floweree and similar soils: 40 percent

Minor Components
Kremlin and similar soils: 0 to 8 percent
Yamacall and similar soils: 0 to 5 percent
Chinook and similar soils: 0 to 2 percent

Major Component Description

Lonna
Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciofluvial deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.1 inches

Floweree
Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)

Drainage class: Well drained
Dominant parent material: Glaciofluvial deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Lothair Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Alluvial fans
Parent material: Lacustrine deposits
Slope range: 4 to 15 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, mixed (calcareous), frigid Aridic Ustorthents

Typical Pedon

Lothair silty clay loam, in an area of Lothair-Marias complex, 4 to 15 percent slopes, in an area of nonirrigated cropland, 100 feet north and 1,400 feet west of the southeast corner of sec. 18, T. 24 N., R. 3 W.

Ap—0 to 6 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; moderate fine granular structure; hard, friable, very sticky, moderately plastic; common fine roots; common vesicular pores; strongly effervescent; slightly alkaline; clear smooth boundary.

By1—6 to 14 inches; pale brown (10YR 6/3) silty clay, dark brown (10YR 4/3) moist; few faint yellowish brown (10YR 6/6) relict mottles; weak coarse prismatic structure parting to moderate fine and medium granular; very hard, firm, very sticky, very plastic; common fine roots; common very fine and fine pores; few fine masses of gypsum; strongly effervescent; slightly alkaline; clear smooth boundary.

By2—14 to 27 inches; light brownish gray (2.5Y 6/2) silty clay loam with thin strata of silt loam, and silty clay, grayish brown (2.5Y 5/2) moist; common distinct yellowish brown (10YR 5/8) and brownish yellow (10YR 6/6) relict mottles between plates; strong and fine and medium platy structure; extremely hard, firm, very sticky, very plastic; few fine roots; few very fine pores; common fine masses of gypsum between larger plates; strongly effervescent; moderately alkaline; clear smooth boundary.

By3—27 to 42 inches; light brownish gray (2.5Y 6/2) silty clay loam with thin strata of silt loam and silty clay, grayish brown (2.5Y 5/2) moist; common distinct yellowish brown (10YR 5/8) relict mottles between larger plates; strong thin and medium platy structure; extremely hard, firm, very sticky, very plastic; common fine masses of gypsum between larger plates; strongly effervescent; moderately alkaline; clear smooth boundary.

BC—42 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam with thin strata of silt loam and silty clay, grayish brown (2.5Y 5/2) moist; common distinct yellowish brown (10YR 5/8) relict mottles between larger plates; strong thin and medium platy structure; extremely hard, firm, very sticky, very plastic; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F

Ap horizon
Hue: 5Y, 2.5Y, or 10YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 35 to 40 percent
Content of rock fragments: 0 to 5 percent pebbles
Reaction: pH 7.4 to 8.4

By and BC horizons
Hue: 5Y, 2.5Y, or 10YR
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Stratified silty clay or silty clay loam
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 5 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 8.4

249D—Lothair-Marias complex, 4 to 15 percent slopes

Setting

Landform:
- Lothair—Alluvial fans
- Marias—Alluvial fans

Slope:
- Lothair—4 to 15 percent
- Marias—4 to 15 percent

Elevation: 3,400 to 3,800 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Lothair and similar soils: 45 percent
Marias and similar soils: 40 percent

Minor Components
Linnet and similar soils: 0 to 6 percent
Lonna and similar soils: 0 to 5 percent
Ethridge and similar soils: 0 to 4 percent

Major Component Description

Lothair
Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Lacustrine deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

Marias
Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Lacustrine deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Manhattan Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Rapid
Landform: Hills
Parent material: Alluvium and eolian deposits
Slope range: 2 to 15 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Coarse-loamy, mixed Typic Calciborolls

Typical Pedon

Manhattan fine sandy loam, in an area of Beanlake-Manhattan-Winspect complex, 2 to 15 percent slopes, in an area of rangeland, 2,450 feet north and 1,650 feet east of the southwest corner of sec. 10, T. 22 N., R. 7 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure parting to weak fine granular; soft, very friable, nonsticky, nonplastic; many very fine and fine roots; slightly effervescent; slightly alkaline; clear smooth boundary.

Bk1—6 to 15 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable, nonsticky, nonplastic; common very fine and fine roots; common fine and medium soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—15 to 45 inches; light brownish gray (2.5Y 6/2) sandy loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; soft, very friable, nonsticky, nonplastic; few very fine and fine roots; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C—45 to 60 inches; light brownish gray (10YR 6/2) loamy fine sand, grayish brown (10YR 5/2) moist; massive; loose, very friable, nonsticky, nonplastic; few very fine roots; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Thickness of the mollic epipedon: 7 to 14 inches
Depth to the calcic horizon: 10 to 20 inches

A horizon
Hue: 10YR or 2.5Y
Value: 3 or 4 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 5 to 15 percent
Reaction: pH 7.4 to 7.8

Bk1 horizon
Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 or 3
Clay content: 5 to 10 percent

Content of rock fragments: 0 to 25 percent pebbles
Calcium carbonate equivalent: 5 to 25 percent
Reaction: pH 7.4 to 8.4

Bk2 horizon
Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 or 3
Clay content: 5 to 10 percent
Content of rock fragments: 0 to 25 percent pebbles
Calcium carbonate equivalent: 15 to 40 percent
Reaction: pH 7.9 to 8.4

C horizon
Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 or 3
Clay content: 0 to 5 percent
Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent pebbles
Calcium carbonate equivalent: 5 to 20 percent
Reaction: pH 7.9 to 8.4

Marcott Series

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Permeability: Slow
Landform: Alluvial fans
Parent material: Alluvium
Slope range: 0 to 2 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, mixed Aquic Haploborolls

Typical Pedon

Marcott silty clay loam, 0 to 2 percent slopes, in an area of nonirrigated cropland, 2,500 feet north and 500 feet west of the southeast corner of sec. 18, T. 28 N., R. 2 W.

Apz—0 to 6 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; hard, friable, moderately sticky, moderately plastic; common fine roots; common fine masses of salt crystals; slightly effervescent; slightly alkaline; clear smooth boundary.

Bz—6 to 16 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; very hard, firm, moderately sticky, moderately plastic; common fine roots; common fine pores; common fine masses of salt crystals; slightly effervescent; slightly alkaline; clear smooth boundary.

Bkz1—16 to 24 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; few fine faint yellowish brown (10YR 5/4) redox concentrations; weak medium prismatic structure parting to weak fine and medium subangular blocky; very hard, firm, moderately sticky, moderately plastic; common fine roots; common very fine and fine pores; common fine masses of salt crystals; few fine soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bkz2—24 to 48 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 4/2) moist; few fine distinct yellowish brown (10YR 5/6) redox concentrations; weak fine subangular blocky structure; extremely hard, firm, very sticky, moderately plastic; few fine roots; few very fine and fine pores; few fine masses of salt crystals; common fine soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cz—48 to 60 inches; light brownish gray (2.5Y 6/2) varved silty clay loam, grayish brown (2.5Y 4/2) moist; few fine distinct yellowish brown (10YR 5/4) redox concentrations; extremely hard, firm, very sticky, moderately plastic; common fine nests and seams of salt crystals; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Thickness of the mollic epipedon: 7 to 15 inches
Depth to the Bkz horizon: 12 to 24 inches
Depth to the seasonal high water table: 24 to 36 inches

Apz horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 2 or 3 moist; 3 to 5 dry
Chroma: 1 or 2
Clay content: 30 to 40 percent
Content of rock fragments: 0 to 5 percent pebbles
Electrical conductivity: 4 to 8 mmhos/cm
Sodium adsorption ratio: 0 to 20
Reaction: pH 6.6 to 8.4

Bz horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 3 to 5 moist; 4 to 7 dry
Chroma: 1 to 3

Texture: Clay loam, silty clay loam, silty clay, or clay
Clay content: 35 to 50 percent
Content of rock fragments: 0 to 5 percent pebbles
Electrical conductivity: 2 to 8 mmhos/cm
Sodium adsorption ratio: 0 to 25
Calcium carbonate equivalent: 3 to 12 percent
Reaction: pH 7.4 to 8.4

Bkz horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 moist; 4 to 7 dry
Chroma: 1 to 3
Texture: Clay loam, silty clay loam, silty clay, or clay
Clay content: 35 to 50 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Electrical conductivity: 2 to 8 mmhos/cm
Sodium adsorption ratio: 0 to 30
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 9.0

Cz horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 moist; 4 to 7 dry
Chroma: 1 to 3
Clay content: 25 to 50 percent
Content of rock fragments: 0 to 80 percent—0 to 10 percent cobbles; 0 to 70 percent pebbles
Electrical conductivity: 2 to 8 mmhos/cm
Sodium adsorption ratio: 0 to 20
Reaction: pH 7.4 to 9.0

241A—Marcott silty clay loam, 0 to 2 percent slopes

Setting

Landform: Alluvial fans
Slope: 0 to 2 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Marcott and similar soils: 85 percent

Minor Components
Kobase and similar soils: 0 to 7 percent
Richey and similar soils: 0 to 6 percent
McKenzie and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Apparent
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 8.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Marias Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Very slow
Landform: Alluvial fans and glaciated till plains
Parent material: Lacustrine deposits and glaciolacustrine deposits
Slope range: 0 to 15 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic, frigid Chromic Udic Haplusterts

Typical Pedon

Marias silty clay, 0 to 4 percent slopes, in an area of nonirrigated cropland, 200 feet north and 1,000 feet west of the southeast corner of sec. 24, T. 25 N., T. 4 W.

Ap—0 to 5 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; strong fine granular structure; very hard, firm, moderately sticky, very plastic; common fine roots; common fine irregular pores; slightly effervescent; slightly alkaline; clear smooth boundary.
Bw—5 to 11 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; strong fine subangular blocky structure; extremely hard, firm, moderately sticky, very plastic; common fine roots; few very fine tubular pores; common

cracks; strongly effervescent; slightly alkaline; gradual smooth boundary.

Bss—11 to 30 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 5/2) moist; strong fine subangular blocky structure; extremely hard, firm, moderately sticky, very plastic; few fine roots; few very fine tubular pores; common cracks and common slickensides that intersect at 20 to 50 degree angles; strongly effervescent; slightly alkaline; clear smooth boundary.

Bssy—30 to 60 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak fine subangular blocky structure; extremely hard, firm, moderately sticky, very plastic; few slickensides upper part; common fine threads of gypsum crystals; strongly effervescent; slightly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the By horizon: 20 to 45 inches
Linear extensibility: .06 to .10 in the upper 30 inches of soil

Ap horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 1 to 3
Clay content: 40 to 60 percent
Electrical conductivity: 0 to 4 mmhos/cm
Sodium adsorption ratio: 1 to 4
Calcium carbonate equivalent: 1 to 5 percent
Reaction: pH 7.4 to 8.4

Bw horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Clay or silty clay
Clay content: 40 to 60 percent
Electrical conductivity: 0 to 4 mmhos/cm
Sodium adsorption ratio: 1 to 4
Calcium carbonate equivalent: 1 to 10 percent
Reaction: pH 7.9 to 8.4

Bss horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Clay or silty clay
Clay content: 40 to 60 percent
Slickensides: Common or many
Electrical conductivity: 2 to 4 mmhos/cm
Sodium adsorption ratio: 1 to 4
Calcium carbonate equivalent: 1 to 10 percent
Reaction: pH 7.9 to 9.0

Bssy horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 3 to 5 moist
Chroma: 1 to 3
Texture: Clay or silty clay
Clay content: 40 to 60 percent
Gypsum: 1 to 6 percent
Electrical conductivity: 2 to 4 mmhos/cm above a depth of 30 inches; 2 to 8 mmhos/cm below 30 inches
Sodium adsorption ratio: 1 to 4 above 30 inches; 4 to 13 below 30 inches
Calcium carbonate equivalent: 2 to 10 percent
Reaction: pH 7.9 to 9.0

44B—Marias silty clay, 0 to 4 percent slopes

Setting

Landform: Till plains
Slope: 0 to 4 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Marias and similar soils: 85 percent

Minor Components
Kobase and similar soils: 0 to 5 percent
Linnet and similar soils: 0 to 5 percent
Ethridge and similar soils: 0 to 3 percent
Nishon and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

50B—Marias-Nunemaker complex, 0 to 4 percent slopes

Setting

Landform:
- Marias—Till plains
- Nunemaker—Till plains

Position on landform:
- Marias—Toeslopes
- Nunemaker—Shoulders

Slope:
- Marias—0 to 4 percent
- Nunemaker—0 to 4 percent

Elevation: 3,300 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Marias and similar soils: 45 percent
Nunemaker and similar soils: 40 percent

Minor Components
Ethridge and similar soils: 0 to 5 percent
Kobase and similar soils: 0 to 5 percent
Scobey and similar soils: 0 to 3 percent
McKenzie and similar soils: 0 to 2 percent

Major Component Description

Marias
Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.5 inches

Nunemaker
Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

150B—Marias-Linnet silty clays, 0 to 4 percent slopes

Setting

Landform:
- Marias—Till plains
- Linnet—Till plains

Slope:
- Marias—0 to 4 percent
- Linnet—0 to 4 percent

Elevation: 3,300 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Marias and similar soils: 55 percent
Linnet and similar soils: 35 percent

Minor Components
Ethridge and similar soils: 0 to 6 percent
Lothair and similar soils: 0 to 2 percent
McKenzie and similar soils: 0 to 2 percent

Major Component Description

Marias
Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.5 inches

Linnet
Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Marmarth Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and sedimentary plains
Parent material: Semiconsolidated sedimentary beds
Slope range: 2 to 15 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy, mixed Aridic Argiborolls

Typical Pedon

Marmarth clay loam, in an area of Rootel-Marmarth loams, 2 to 8 percent slopes, in an area of rangeland, 1,100 feet south and 600 feet east of the northwest corner of sec. 19, T. 24 N., R. 5 W.

A—0 to 3 inches; grayish brown (10YR 5/2) loam, dark brown (10YR 3/2) moist; moderate medium granular structure; hard, friable, moderately sticky, slightly plastic; many fine roots; many fine vesicular pores; neutral; clear smooth boundary.

Bt—3 to 12 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; strong medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, friable, moderately sticky, moderately plastic; many very fine and fine roots; many very fine and fine tubular pores; few distinct very dark grayish brown (10YR 3/2) clay films; neutral; clear smooth boundary.

Bk1—12 to 16 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; strong medium prismatic structure parting to moderate medium subangular blocky; very hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; common very fine and fine tubular pores; few or common soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—16 to 32 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure in the upper part grading to weak coarse prismatic structure in the lower part, parting to weak medium subangular blocky structure; common very fine and fine roots in the upper part grading to few very fine roots in the lower part; common very fine pores; many soft masses of lime; 20 percent soft shale fragments; violently effervescent; moderately alkaline; clear wavy boundary.

Cr—32 to 60 inches; light brownish gray (2.5Y 6/2) semiconsolidated siltstone; grayish brown (2.5Y 5/2) moist; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Cr horizon: 20 to 40 inches
Thickness of the mollic epipedon: 7 to 12 inches

A horizon
Hue: 10YR
Value: 3 to 5 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 20 to 35 percent
Reaction: pH 6.1 to 7.3

Bt horizon
Hue: 10YR or 2.5Y
Value: 3 to 6 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy clay loam
Clay content: 18 to 35 percent
Reaction: pH 6.1 to 7.8

Bk horizons
Hue: 2.5Y or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, fine sandy loam, clay loam, or silty clay loam
Clay content: 15 to 30 percent
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

Cr horizon
Semiconsolidated siltstone or sandstone

377C—Marmarth-Delpoint-Cabbart complex, 2 to 8 percent slopes

Setting

Landform:
- Marmarth—Sedimentary plains
- Delpoint—Sedimentary plains
- Cabbart—Sedimentary plains

Position on landform:
- Marmarth—Footslopes
- Delpoint—Backslopes and footslopes
- Cabbart—Shoulders

Slope:
- Marmarth—2 to 8 percent
- Delpoint—2 to 8 percent
- Cabbart—2 to 8 percent

Elevation: 3,600 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Marmarth and similar soils: 35 percent
Delpoint and similar soils: 30 percent
Cabbart and similar soils: 20 percent

Minor Components
Yamacall and similar soils: 0 to 6 percent
Evanston and similar soils: 0 to 5 percent
Kremlin and similar soils: 0 to 4 percent

Major Component Description

Marmarth
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.2 inches

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.1 inches

Cabbart
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

477C—Marmarth-Evanston-Delpoint complex, 2 to 15 percent slopes

Setting

Landform:
- Marmarth—Hills
- Evanston—Alluvial fans
- Delpoint—Hills

Position on landform:
- Marmarth—Backslopes and shoulders
- Delpoint—Backslopes and shoulders

Slope:
- Marmarth—2 to 15 percent
- Evanston—2 to 8 percent
- Delpoint—2 to 15 percent

Elevation: 3,600 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Marmarth and similar soils: 35 percent
Evanston and similar soils: 30 percent
Delpoint and similar soils: 20 percent

Minor Components
Cabbart and similar soils: 0 to 8 percent
Kremlin and similar soils: 0 to 4 percent
Yamacall and similar soils: 0 to 3 percent

Major Component Description

Marmarth
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.2 inches

Evanston
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium

Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.1 inches

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Marvan Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Very slow
Landform: Alluvial fans and glaciated till plains
Parent material: Alluvium and lacustrine deposits
Slope range: 0 to 4 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic, frigid Sodic Haplusterts

Typical Pedon

Marvan clay, in an area of Vanda-Marvan clays, 0 to 2 percent slopes, in an area of rangeland, 400 feet north and 900 feet west of the southeast corner of sec. 29, T. 23 N., R. 1 E.

A—0 to 4 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak thick platy structure parting to strong medium subangular blocky; extremely hard, firm, very sticky, very plastic; common very fine and fine roots; few very fine vesicular pores; neutral; clear smooth boundary.

Bw—4 to 13 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; extremely hard, firm, very sticky, very plastic; common fine and medium roots; few very fine pores; common cracks; neutral; clear wavy boundary.

Bss—13 to 20 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure; extremely hard, firm, very sticky, very plastic; common fine roots; common very fine pores; common cracks and common slickensides that intersect at 20 to 50 degree angles; slightly effervescent; neutral; gradual wavy boundary.

Bssy—20 to 33 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, moderately sticky, moderately plastic; common very fine roots; common very fine pores; few slickensides; few fine masses and seams of gypsum; slightly effervescent; slightly alkaline; gradual wavy boundary.

Bnssyz—33 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, very firm, very sticky, very plastic; few very fine roots; few slickensides; common medium masses and seams of gypsum and other salts; slightly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Average annual summer temperature: 60 to 68 degrees F
Depth to the Bssy horizon: 10 to 24 inches
Soil phases: Wet

A horizon
Hue: 2.5Y or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay or silty clay
Clay content: 40 to 60 percent
Electrical conductivity: 0 to 4 mmhos/cm
Sodium adsorption ratio: 0 to 4
Calcium carbonate equivalent: 1 to 5 percent
Reaction: pH 6.6 to 8.4

Bw horizon
Hue: 2.5Y or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay or silty clay
Clay content: 45 to 60 percent
Electrical conductivity: 2 to 4 mmhos/cm
Reaction: pH 6.6 to 9.0

Bss horizon
Hue: 2.5Y or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay or silty clay
Clay content: 45 to 60 percent
Electrical conductivity: 4 to 16 mmhos/cm
Sodium adsorption ratio: 4 to 13
Calcium carbonate equivalent: 1 to 10 percent
Reaction: pH 7.9 to 9.0

Bssy horizon
Hue: 2.5Y or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay or silty clay
Clay content: 45 to 60 percent
Gypsum: 1 to 5 percent
Electrical conductivity: 4 to 16 mmhos/cm
Sodium adsorption ratio: 13 to 38
Calcium carbonate equivalent: 1 to 10 percent
Reaction: pH 7.9 to 9.0

Bnssyz horizon
Hue: 2.5Y or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay or silty clay that includes thin layers of silty clay loam and silt loam material
Clay content: 45 to 60 percent
Gypsum: 1 to 5 percent
Electrical conductivity: 8 to 16 mmhos/cm
Sodium adsorption ratio: 13 to 38
Calcium carbonate equivalent: 1 to 10 percent
Reaction: pH 7.9 to 9.0

45B—Marvan clay, 0 to 4 percent slopes

Setting

Landform: Till plains
Slope: 0 to 4 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Marvan and similar soils: 85 percent

Minor Components
Marias and similar soils: 0 to 12 percent
McKenzie and similar soils: 0 to 3 percent

Major Component Description

Surface layer texture: Clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

145A—Marvan, wet-Nobe silty clays, 0 to 2 percent slopes

Setting

Landform:
- Marvan, wet—Alluvial fans
- Nobe—Alluvial fans

Position on landform:
- Marvan, wet—Microlows
- Nobe—Microhighs

Slope:
- Marvan, wet—0 to 2 percent
- Nobe—0 to 2 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Marvan, wet and similar soils: 50 percent
Nobe and similar soils: 35 percent

Minor Components
Vanda and similar soils: 0 to 6 percent
Lardell and similar soils: 0 to 5 percent
Absher and similar soils: 0 to 4 percent

Major Component Description

Marvan, wet
Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)

Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Apparent
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 8.2 inches

Nobe
Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 4.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

540B—Marvan silty clay, wet, 0 to 4 percent slopes

Setting

Landform: Till plains
Slope: 0 to 4 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Marvan and similar soils: 85 percent

Minor Components
Marias and similar soils: 0 to 8 percent
Nobe and similar soils: 0 to 5 percent
Lardell and similar soils: 0 to 1 percent
McKenzie and similar soils: 0 to 1 percent

Major Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Apparent
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 8.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

722C—Marvan, wet-Trudau complex, 0 to 8 percent slopes

Setting

Landform:
• Marvan, wet—Alluvial fans
• Trudau—Alluvial fans
Position on landform:
• Marvan, wet—Toeslopes
• Trudau—Footslopes
Slope:
• Marvan, wet—0 to 4 percent
• Trudau—0 to 8 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Marvan, wet, and similar soils: 45 percent
Trudau and similar soils: 45 percent

Minor Components
Rothiemay and similar soils: 0 to 4 percent
Kremlin and similar soils: 0 to 2 percent
McKenzie and similar soils: 0 to 2 percent
Nobe and similar soils: 0 to 2 percent

Major Component Description

Marvan, wet
Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Apparent
Salt affected: Saline within 30 inches

Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 8.2 inches

Trudau
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 9.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

McKenzie Series

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Permeability: Very slow
Landform: Closed depressions
Parent material: Alluvium
Slope range: 0 to 2 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic, frigid Chromic Endoaquerts

Typical Pedon

McKenzie clay, 0 to 2 percent slopes, in an area of rangeland, 50 feet north and 2,500 feet west of the southeast corner of sec. 29, T. 23 N., R. 1 E.

(Colors are for moist soil unless otherwise noted.)

A—0 to 7 inches; dark gray (5Y 4/1) clay, gray (5Y 6/1) dry; 1/2 inch light gray (5Y 7/1) vesicular crust; common fine yellowish brown (10YR 5/6) redox concentrations; moderate medium granular structure; extremely hard, very firm, moderately sticky, very plastic; few fine and medium roots; common very fine and fine pores; weakly effervescent; moderately alkaline; clear smooth boundary.

Bg—7 to 30 inches; dark gray (5Y 4/1) clay, gray (5Y 5/1) dry; few fine distinct yellowish brown (10YR 5/6) redox concentrations; moderate fine and medium subangular blocky structure; extremely hard, very firm, moderately sticky, very plastic; few fine roots; few very fine and fine tubular pores; weakly effervescent; pressure faces or weakly expressed slickensides in lower part; moderately alkaline; gradual wavy boundary.

C—30 to 60 inches; olive gray (5Y 4/2) clay, gray (5Y 5/1) dry; few fine faint brownish yellow (10YR 6/6) redox concentrations; massive; extremely hard, very firm, moderately sticky, very plastic; few very fine pores; weakly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

A horizon
Hue: 5Y, 2.5Y, or 10YR
Value: 4 or 5 moist; 4 to 6 dry
Chroma: 1 or 2
Clay content: 40 to 60 percent
Electrical conductivity: 2 to 8 mmhos/cm
Reaction: pH 6.6 to 9.0

Bg horizon
Hue: 2.5Y or 5Y
Value: 4 or 5 moist; 5 or 6 dry
Chroma: 1 or 2
Texture: Clay or silty clay
Clay content: 40 to 60 percent
Electrical conductivity: 2 to 8 mmhos/cm
Reaction: pH 6.6 to 9.0

C horizon
Hue: 2.5Y or 5Y
Value: 4 to 6 moist; 5 to 7 dry
Chroma: 1 to 3
Texture: Clay or silty clay
Clay content: 40 to 60 percent
Electrical conductivity: 2 to 8 mmhos/cm
Reaction: pH 7.9 to 9.0

38A—McKenzie clay, 0 to 2 percent slopes

Setting

Landform: Closed depressions
Slope: 0 to 2 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
McKenzie and similar soils: 90 percent

Minor Components
Soils that are poorly drained and loamy: 0 to 5 percent
Kobase and similar soils: 0 to 2 percent
Marias and similar soils: 0 to 2 percent
Ethridge and similar soils: 0 to 1 percent

Major Component Description

Surface layer texture: Clay
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Perched
Ponding: Long
Salt affected: Saline within 30 inches
Available water capacity: Mainly 9.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Meadowcreek Series

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Permeability: Moderate in upper 32 inches; rapid or very rapid below this depth
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Mean annual precipitation: 14 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed Fluvaquentic Haploborolls

Typical Pedon

Meadowcreek loam, in an area of Fairway-Meadowcreek loams, 0 to 2 percent slopes, rarely flooded; in an area of rangeland, 1,750 feet south and 2,400 feet east of the northwest corner of sec. 22, T. 26 N., R. 6 W.

A—0 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many fine and few medium roots; many fine irregular pores; strongly effervescent; slightly alkaline; clear smooth boundary.

C1—10 to 20 inches; grayish brown (10YR 5/2) loam that has thin lenses of fine sandy loam, dark grayish brown (10YR 4/2) moist; common fine faint yellowish brown (10YR 5/4) redox concentrations; massive; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine and few medium roots; many very fine and fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—20 to 32 inches; grayish brown (2.5Y 5/2) loam, grayish brown (2.5Y 4/2) moist; common fine faint yellowish brown (10YR 5/4) redox concentrations; massive; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine and few medium roots; common very fine and fine pores; small pebble-size pieces of highly weathered organic material; strongly effervescent; moderately alkaline; clear wavy boundary.

2C—32 to 60 inches; mixed grayish brown and gray (10YR 5/1 and 2.5Y 5/2) extremely gravelly loamy sand, dark gray and dark grayish brown (10YR 4/1 and 2.5Y 4/2) moist; single grain; loose, nonsticky, nonplastic; few fine and medium roots in the upper part; 55 percent pebbles and 10 percent cobbles; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 10 to 15 inches
Depth to the 2C horizon: 20 to 40 inches
Depth to the seasonal high water table: 36 to 60 inches

A horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist; 4 or 5 dry
Chroma: 1 or 2
Clay content: 18 to 25 percent
Content of rock fragments: 0 to 5 percent pebbles
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 7.4 to 8.4
Calcium carbonate equivalent: 0 to 10 percent

C horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 3 or 4 moist; 5 or 6 dry
Chroma: 1 to 3

Texture: Loam, sandy loam, sandy clay loam, or silt loam
Clay content: 18 to 25 percent
Content of rock fragments: 0 to 5 percent pebbles
Electrical conductivity: 0 to 4 mmhos/cm
Calcium carbonate equivalent: 0 to 10 percent
Reaction: pH 6.6 to 8.4

2C horizon
Texture: Sand or loamy sand
Clay content: 0 to 10 percent
Content of rock fragments: 50 to 75 percent—0 to 15 percent stones and cobbles; 50 to 70 percent pebbles
Reaction: pH 6.1 to 7.8

Megonot Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Hills and sedimentary plains
Parent material: Semiconsolidated shale
Slope range: 0 to 60 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic, frigid Aridic Ustochrepts

Typical Pedon

Megonot silty clay loam, in an area of Megonot-Tanna clay loams, 2 to 8 percent slopes, in an area of nonirrigated cropland, 1,500 feet north and 1,200 feet east of the southwest corner of sec. 29, T. 23 N., R. 2 W.

Ap—0 to 5 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium granular structure; hard, friable, moderately sticky, moderately plastic; many fine roots; many fine vesicular pores; slightly effervescent; neutral; clear smooth boundary.

Bw—5 to 12 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; common very fine and fine discontinuous tubular pores; slightly effervescent; slightly alkaline; clear smooth boundary.

Bk—12 to 21 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, moderately sticky, very plastic; common very fine and fine roots; common very fine discontinuous tubular pores; 10 percent soft weathered shale fragments; few medium soft masses of segregated lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Cy—21 to 29 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive or platy structure as a result of in situ weathering of shale; hard, firm, moderately sticky, moderately plastic; common very fine and fine roots in cracks and between plates; common fine threadlike seams of gypsum; 25 percent soft shale fragments and 10 percent hard shale fragments; slightly effervescent; moderately alkaline; gradual wavy boundary.

Cr—29 to 60 inches; mixed dark gray (5Y 4/1) and olive gray (5Y 4/2) semiconsolidated shale; hard and firm; neutral.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Depth to the Bk horizon: 11 to 27 inches
Depth to the Cr horizon: 20 to 40 inches

Ap horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Silty clay loam or clay loam
Clay content: 35 to 40 percent
Coarse rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.6 to 7.8

Bw horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Silty clay loam, clay loam, or silty clay
Clay content: 35 to 45 percent
Coarse rock fragments: 0 to 15 percent hard pebbles;
0 to 15 percent soft pebbles
Reaction: pH 7.4 to 8.4

Bk horizon
Hue: 2.5Y or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Silty clay loam, clay loam, or silty clay
Clay content: 35 to 45 percent

Coarse rock fragments: 0 to 15 percent hard pebbles;
0 to 15 percent soft pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

Cy horizon
Hue: 2.5Y or 5Y
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 2 or 3
Texture: Silty clay loam, clay loam, or silty clay
Clay content: 35 to 45 percent
Coarse rock fragments: 10 to 50 percent soft shale;
5 to 30 percent hard shale fragments
Gypsum: 1 to 5 percent
Reaction: pH 6.6 to 8.4

Cr horizon
Reaction: pH 5.6 to 7.8

70B—Megonot silty clay loam, 0 to 4 percent slopes

Setting

Landform: Sedimentary plains
Slope: 0 to 4 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Megonot and similar soils: 90 percent

Minor Components
Tanna and similar soils: 0 to 4 percent
Kobase and similar soils: 0 to 3 percent
Abor and similar soils: 0 to 2 percent
Yawdim and similar soils: 0 to 1 percent

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

148C—Megonot-Richey-Tanna clay loams, 2 to 8 percent slopes

Setting

Landform:
- Megonot—Sedimentary plains
- Richey—Sedimentary plains
- Tanna—Sedimentary plains

Position on landform:
- Megonot—Backslopes and shoulders
- Richey—Footslopes
- Tanna—Footslopes

Slope:
- Megonot—2 to 8 percent
- Richey—2 to 8 percent
- Tanna—2 to 8 percent

Elevation: 3,400 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Megonot and similar soils: 35 percent
Richey and similar soils: 30 percent
Tanna and similar soils: 20 percent

Minor Components
Ethridge and similar soils: 0 to 7 percent
Kevin and similar soils: 0 to 5 percent
Scobey and similar soils: 0 to 3 percent

Major Component Description

Megonot
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.0 inches

Richey
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland

Flooding: None
Available water capacity: Mainly 8.7 inches

Tanna
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

270C—Megonot-Tanna clay loams, 2 to 8 percent slopes

Setting

Landform:
- Megonot—Sedimentary plains
- Tanna—Sedimentary plains

Position on landform:
- Megonot—Backslopes and shoulders
- Tanna—Footslopes

Slope:
- Megonot—2 to 8 percent
- Tanna—2 to 8 percent

Elevation: 3,400 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Megonot and similar soils: 45 percent
Tanna and similar soils: 40 percent

Minor Components
Scobey and similar soils: 0 to 6 percent
Ethridge and similar soils: 0 to 5 percent
Kevin and similar soils: 0 to 4 percent

Major Component Description

Megonot
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.6 inches

Tanna
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

367F—Megonot-Yawdim-Crago complex, 15 to 60 percent slopes

Setting

Landform:
- Megonot—Hills
- Yawdim—Hills
- Crago—Hills

Position on landform:
- Megonot—Backslopes
- Yawdim—Backslopes and shoulders
- Crago—Risers

Slope:
- Megonot—15 to 60 percent
- Yawdim—15 to 60 percent
- Crago—15 to 60 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Megonot and similar soils: 35 percent
Yawdim and similar soils: 35 percent
Crago and similar soils: 15 percent

Minor Components
Abor and similar soils: 0 to 5 percent
Areas of rock outcrop: 0 to 5 percent
Cabbart and similar soils: 0 to 5 percent

Major Component Description

Megonot
Surface layer texture: Silty clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.9 inches

Yawdim
Surface layer texture: Silty clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.9 inches

Crago
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

570D—Megonot-Kobase-Yawdim complex, 8 to 15 percent slopes

Setting

Landform:
- Megonot—Hills
- Kobase—Alluvial fans
- Yawdim—Hills

Position on landform:
- Megonot—Backslopes and footslopes
- Yawdim—Shoulders and summits

Slope:
- Megonot—8 to 15 percent
- Kobase—8 to 15 percent
- Yawdim—8 to 15 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Megonot and similar soils: 35 percent
Kobase and similar soils: 30 percent
Yawdim and similar soils: 20 percent

Minor Components
Tanna and similar soils: 0 to 7 percent
Abor and similar soils: 0 to 6 percent
Cabbart and similar soils: 0 to 2 percent

Major Component Description

Megonot
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.9 inches

Kobase
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 9.6 inches

Yawdim
Surface layer texture: Silty clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

589F—Megonot-Yawdim-Rock outcrop complex, 25 to 60 percent slopes

Setting

Landform:
- Megonot—Hills
- Yawdim—Hills
- Rock outcrop—Escarpments

Position on landform:
- Megonot—Backslopes
- Yawdim—Shoulders and summits

Slope:
- Megonot—25 to 60 percent
- Yawdim—25 to 60 percent
- Rock outcrop—25 to 60 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Megonot and similar soils: 35 percent
Yawdim and similar soils: 30 percent
Rock outcrop: 20 percent

Minor Components
Cabbart and similar soils: 0 to 7 percent
Abor and similar soils: 0 to 5 percent
Kobase and similar soils: 0 to 3 percent

Major Component Description

Megonot
Surface layer texture: Silty clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.9 inches

Yawdim
Surface layer texture: Silty clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.7 inches

Rock outcrop
Definition: Semiconsolidated shale bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

M-W—Miscellaneous water

Composition

Major Components
Miscellaneous water: 100 percent

Major Component Description

Definition: Open water areas such as sewage lagoons, industrial waste pits, and fish hatcheries

Neldore Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Hills and sedimentary plains
Parent material: Residuum from semiconsolidated shale
Slope range: 2 to 70 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Clayey, montmorillonitic, nonacid, frigid, shallow Aridic Ustorthents

Typical Pedon

Neldore clay, in an area of Neldore-Lambeth-Rock outcrop complex, 35 to 70 percent slopes, in an area of rangeland, 500 feet south and 300 feet west of the northeast corner of sec. 14, T. 29 N., R. 2 W.

A—0 to 4 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; moderate medium granular structure; hard, friable, moderately sticky, moderately plastic; common fine roots; many fine

pores; thin (1/2 inch) light olive gray (5Y 6/2) vesicular crust on surface; 5 percent pebbles; neutral; clear smooth boundary.

C1—4 to 10 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; massive; very hard, friable, moderately sticky, moderately plastic; common fine roots; many fine pores; 20 percent weathered soft shale fragments; neutral; gradual wavy boundary.

C2—10 to 18 inches; olive gray (5Y 5/2) shaly clay, olive gray (5Y 4/2) moist; massive; hard, firm, moderately sticky, moderately plastic; common very fine roots on plates between shale fragments; 30 percent soft weathered shale fragments and 15 percent hard platy shale fragments; neutral; gradual wavy boundary.

Cr—18 to 60 inches; gray (5Y 5/1) semiconsolidated shale; moderately acid.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Cr horizon: 10 to 20 inches
Other features: Dark colors below the A horizon are inherited from the parent shale.

A horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 1 or 2
Clay content: 40 to 50 percent
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 5.6 to 7.8

C1 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 1 or 2; 4 or 6 for stains of shale
Texture: Clay or silt clay
Clay content: 40 to 60 percent
Content of rock fragments: 5 to 35 percent—5 to 25 percent soft shale fragments; 0 to 10 percent hard shale fragments
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 5.6 to 7.8

C2 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 1 or 2
Texture: Clay or silty clay
Clay content: 40 to 60 percent
Electrical conductivity: 0 to 4 mmhos/cm
Content of rock fragments: 65 to 90 percent—65 to 75 percent soft shale fragments; 0 to 15 percent hard shale fragments
Reaction: pH 5.6 to 7.8

Cr horizon
Other features: The shale fragments are extremely hard or very hard when dry and extremely firm or very firm when moist.
Reaction: pH 5.1 to 7.3

286F—Neldore-Bascovy-Rock outcrop complex, 25 to 60 percent slopes

Setting

Landform:
- Neldore—Hills
- Bascovy—Hills
- Rock outcrop—Escarpments

Position on landform:
- Neldore—Shoulders and summits
- Bascovy—Backslopes and shoulders

Slope:
- Neldore—25 to 60 percent
- Bascovy—25 to 45 percent
- Rock outcrop—25 to 60 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Neldore and similar soils: 45 percent
Bascovy and similar soils: 20 percent
Rock outcrop: 20 percent

Minor Components
Yawdim and similar soils: 0 to 12 percent
Kobase and similar soils: 0 to 3 percent

Major Component Description

Neldore
Surface layer texture: Clay
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.6 inches

Bascovy
Surface layer texture: Silty clay
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum

Native plant cover type: Rangeland
Flooding: None
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 3.7 inches

Rock outcrop
Definition: Semiconsolidated shale bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

486F—Neldore-Lambeth-Rock outcrop complex, 35 to 70 percent slopes

Setting

Landform:
- Neldore—Hills
- Lambeth—Hills
- Rock outcrop—Escarpments

Position on landform:
- Neldore—Shoulders and summits
- Lambeth—Backslopes and shoulders

Slope:
- Neldore—35 to 70 percent
- Lambeth—35 to 70 percent
- Rock outcrop—35 to 70 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Neldore and similar soils: 40 percent
Lambeth and similar soils: 25 percent
Rock outcrop: 20 percent

Minor Components
Bascovy and similar soils: 0 to 9 percent
Abor and similar soils: 0 to 3 percent
Yawdim and similar soils: 0 to 3 percent

Major Component Description

Neldore
Surface layer texture: Clay
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.6 inches

Lambeth
Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 11.4 inches

Rock outcrop
Definition: Semiconsolidated shale bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Nesda Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Rapid
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Sandy-skeletal, mixed Fluventic Haploborolls

Typical Pedon

Nesda gravelly loam, in an area of Ridgelawn-Nesda-Korchea complex, 0 to 2 percent slopes, occasionally flooded; in an area of forest land, 850 feet south and 600 feet west of the northeast corner of sec. 36, T. 25 N., R. 7 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; weak medium granular structure; soft, very friable, slightly sticky, nonplastic; many fine roots; many fine vesicular pores; 5 percent pebbles; slightly effervescent; slightly alkaline; clear wavy boundary.

A2—5 to 10 inches; dark grayish brown (10YR 4/2) very gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky, nonplastic; many fine roots; many very fine and fine vesicular pores; 45 percent pebbles; strongly effervescent; lime coats on undersides of larger coarse rock fragments; slightly alkaline; clear wavy boundary.

2C1—10 to 24 inches; grayish brown (10YR 5/2) extremely gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; nonsticky, nonplastic; common very fine and fine roots; 70 percent pebbles and 10 percent cobbles; strongly effervescent; lime coats on undersides of larger coarse rock fragments; moderately alkaline; gradual wavy boundary.

2C2—24 to 60 inches; grayish brown (10YR 5/2) extremely gravelly sand, dark grayish brown (10YR 4/2) moist; single grain; nonsticky, nonplastic; 70 percent pebbles and 10 percent cobbles; lime coats on undersides of larger coarse rock fragments in upper part; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 10 to 16 inches
Depth to the 2C horizon: 10 to 20 inches

A horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 to 3
Clay content: 10 to 20 percent
Content of rock fragments: 0 to 65 percent—0 to 15 percent stones and cobbles; 0 to 55 percent pebbles
Calcium carbonate equivalent: 0 to 5 percent
Reaction: pH 6.6 to 7.8

2C horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 7 dry; 3 to 5 moist
Chroma: 1 to 4
Texture: Sand or loamy sand
Clay content: 0 to 10 percent
Content of rock fragments: 35 to 80 percent—0 to 10 percent stones and cobbles; 35 to 70 percent pebbles
Calcium carbonate equivalent: 0 to 5 percent
Reaction: pH 7.4 to 8.4

109B—Nesda, occasionally flooded-Riverwash complex, 0 to 4 percent slopes

Setting

Landform:
- Nesda—Flood plains
- Riverwash—Flood plains

Slope:
- Nesda—0 to 4 percent
- Riverwash—0 to 4 percent

Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Nesda and similar soils: 50 percent
Riverwash: 35 percent

Minor Components
Ridgelawn and similar soils: 0 to 10 percent
Korchea and similar soils: 0 to 5 percent

Major Component Description

Nesda
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forest land
Flooding: Occasional
Available water capacity: Mainly 3.4 inches

Riverwash
Definition: Areas of recently deposited alluvial material reworked often by flood waters. These areas support little or no vegetation.
Flooding: Frequent
Water table: Apparent

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Niart Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Stream terraces and relict stream terraces
Parent material: Alluvium
Slope range: 0 to 8 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy, carbonatic Aridic Calciborolls

Typical Pedon

Niart clay loam, in an area of Rothiemay-Niart clay loams, 0 to 4 percent slopes, in an area of irrigated cropland, 1,000 feet north and 2,600 feet east of the southwest corner of sec. 20, T. 22 N., R. 2 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to weak fine granular; slightly hard, very friable, moderately sticky, moderately plastic; common fine roots; many fine irregular pores; 5 percent pebbles; slightly effervescent; moderately alkaline; abrupt smooth boundary.

Bw—6 to 10 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, moderately sticky, moderately plastic; common fine roots; common fine and medium tubular pores; 10 percent pebbles; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk1—10 to 19 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, moderately sticky, moderately plastic; few fine roots; common fine tubular pores; 10 percent pebbles; many medium soft masses of lime throughout; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—19 to 30 inches; light gray (2.5Y 7/2) clay loam, light brownish gray (2.5Y 6/2) moist; weak coarse prismatic structure parting to strong fine and medium subangular blocky; hard, friable, moderately sticky, moderately plastic; few very fine roots; many very fine vesicular pores; 5 percent pebbles; many medium and coarse soft masses of lime throughout; violently effervescent; moderately alkaline; gradual wavy boundary.

2C—30 to 60 inches; white (2.5Y 8/2) very gravelly loam, light brownish gray (2.5Y 6/2) moist; massive; hard, friable, moderately sticky, moderately plastic; 55 percent pebbles with lime crusts on undersides of larger pebbles; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 10 inches
Depth to the Bk horizon: 6 to 17 inches
Depth to the 2C horizon: 19 to 40 inches

Ap horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 3 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 5 to 45 percent—0 to 5 percent cobbles; 5 to 40 percent pebbles
Reaction: pH 7.4 to 8.4

Bw horizon
Hue: 10YR or 2.5Y
Value: 6 or 7 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 18 to 30 percent
Content of rock fragments: 5 to 35 percent—0 to 10 percent stones and cobbles; 5 to 25 percent pebbles
Reaction: pH 7.8 to 8.4

Bk horizons
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 25 to 35 percent (20 to 30 percent noncarbonate clay)
Content of rock fragments: 5 to 30 percent—0 to 5 percent cobbles; 5 to 25 percent pebbles
Calcium carbonate equivalent: 40 to 55 percent
Reaction: pH 7.9 to 8.4

2C horizon
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 or 4
Texture: Loam, sandy clay loam, or sandy loam
Clay content: 20 to 30 percent (15 to 25 percent noncarbonate clay)

Content of rock fragments: 35 to 80 percent—5 to 10 percent cobbles; 30 to 70 percent pebbles
Calcium carbonate equivalent: 45 to 55 percent
Reaction: pH 7.9 to 8.4

115B—Niart-Crago-Arrod gravelly loams, 0 to 4 percent slopes

Setting

Landform:
- Niart—Relict stream terraces
- Arrod—Relict stream terraces
- Crago—Relict stream terraces

Slope:
- Niart—0 to 4 percent
- Arrod—0 to 4 percent
- Crago—0 to 4 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Niart and similar soils: 35 percent
Arrod and similar soils: 30 percent
Crago and similar soils: 30 percent

Minor Components
Rothiemay and similar soils: 0 to 4 percent
Varney and similar soils: 0 to 1 percent

Major Component Description

Niart
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.1 inches

Arrod
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.6 inches

Crago
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

230B—Niart-Crago gravelly loams, 0 to 4 percent slopes

Setting

Landform:
- Niart—Relict stream terraces
- Crago—Relict stream terraces

Slope:
- Niart—0 to 4 percent
- Crago—0 to 4 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Niart and similar soils: 55 percent
Crago and similar soils: 30 percent

Minor Components
Arrod and similar soils: 0 to 6 percent
Rothiemay and similar soils: 0 to 5 percent
Varney and similar soils: 0 to 4 percent

Major Component Description

Niart
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.2 inches

Crago
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium

Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

230C—Niart-Crago gravelly loams, 4 to 8 percent slopes

Setting

Landform:
- Niart—Relict stream terraces
- Crago—Relict stream terraces

Position on landform:
- Niart—Footslopes
- Crago—Backslopes and shoulders

Slope:
- Niart—4 to 8 percent
- Crago—4 to 8 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Niart and similar soils: 50 percent
Crago and similar soils: 35 percent

Minor Components
Arrod and similar soils: 0 to 6 percent
Rothiemay and similar soils: 0 to 6 percent
Varney and similar soils: 0 to 3 percent

Major Component Description

Niart
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.2 inches

Crago
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

330B—Niart gravelly loam, 0 to 4 percent slopes

Setting

Landform: Relict stream terraces
Slope: 0 to 4 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Niart and similar soils: 85 percent

Minor Components
Crago and similar soils: 0 to 7 percent
Rothiemay and similar soils: 0 to 4 percent
Arrod and similar soils: 0 to 3 percent
Varney and similar soils: 0 to 1 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Nishon Series

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Permeability: Very slow
Landform: Closed depressions
Parent material: Alluvium
Slope range: 0 to 2 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic, frigid Typic Albaqualfs

Typical Pedon

Nishon silt loam, 0 to 2 percent slopes, in an area of nonirrigated cropland, 850 feet north and 850 feet east of the southwest corner of sec. 36, T. 30 N., R. 3 W.

Ap1—0 to 3 inches; light brownish gray (10YR 6/2) silt loam, dark gray (10YR 4/1) moist; common fine distinct dark yellowish brown (10YR 4/4) redox concentrations; moderate medium granular structure; slightly hard, very friable, moderately sticky, slightly plastic; many very fine and fine roots; many fine tubular pores; slightly alkaline; clear smooth boundary.

Ap2—3 to 6 inches; light brownish gray (10YR 6/2) silt loam, dark gray (10YR 4/1) moist; common fine distinct dark yellowish brown (10YR 4/4) redox concentrations; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, slightly plastic; many very fine and fine roots; many fine tubular pores; slightly alkaline; abrupt smooth boundary.

Bt1—6 to 11 inches; grayish brown (10YR 5/2) silty clay, dark gray (10YR 4/1) moist; strong medium and coarse prismatic structure parting to moderate fine and medium angular blocky; extremely hard, firm, moderately sticky, moderately plastic; common very fine and fine roots; common fine tubular pores; common distinct clay films; moderately alkaline; clear smooth boundary.

Bt2—11 to 24 inches; grayish brown (10YR 5/2) silty clay, dark gray (10YR 4/1) moist; strong medium and coarse prismatic structure parting to moderate medium angular blocky; extremely hard, firm, moderately sticky, moderately plastic; common very fine and fine roots; common fine tubular pores; common distinct clay films; moderately alkaline; gradual wavy boundary.

Bt3—24 to 32 inches; pale brown (10YR 6/3) silty clay, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; extremely hard, firm, very sticky, moderately plastic; few very fine roots; common very fine irregular pores; few faint clay films; slightly effervescent; moderately alkaline; gradual wavy boundary.

Bk—32 to 46 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; common fine faint dark yellowish brown (10YR 4/4) redox concentrations; massive; very hard, friable, very sticky, very plastic; common very fine irregular pores; common fine threads of lime; strongly effervescent; strongly alkaline; gradual wavy boundary.

Bky—46 to 60 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; common fine and medium distinct dark yellowish brown (10YR 4/4) redox concentrations; massive; very hard, friable, very sticky, very plastic; common very fine irregular pores; common fine soft threads of lime and gypsum; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Bk horizon: 15 to 35 inches

Ap horizons
Hue: 2.5Y or 10YR
Value: 4 or 5 moist; 5 to 7 dry
Chroma: 1 or 2
Redox features: None to common, distinct to prominent (10YR 5/3, 4/3, 4/4) concentrations
Clay content: 20 to 27 percent
Reaction: pH 6.1 to 8.4

Bt horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 3 to 5 moist; 4 to 6 dry
Chroma: 1 to 3
Redox features: None to common, distinct to prominent (10YR 5/3, 4/3, 4/4, or 2.5Y 5/3) concentrations
Texture: Clay or silty clay
Clay content: 40 to 60 percent
Reaction: pH 6.6 to 9.0

Bk horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 moist; 5 to 7 dry
Chroma: 1 to 3
Redox features: None to common, distinct to prominent (10YR 4/4, 6/4 moist) concentrations

Texture: Clay loam, silty clay loam, clay, or silty clay
Clay content: 35 to 55 percent
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 9.0

Bky horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 moist; 5 to 7 dry
Chroma: 2 or 3
Redox features: None to common, distinct to prominent (10YR 4/4, 6/4 moist) concentrations
Texture: Clay loam, silty clay loam, clay, or silty clay
Clay content: 35 to 55 percent
Calcium carbonate equivalent: 1 to 12 percent
Gypsum: 1 to 3 percent
Reaction: pH 7.4 to 9.0

52A—Nishon silt loam, 0 to 2 percent slopes

Setting

Landform: Closed depressions
Slope: 0 to 2 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Nishon and similar soils: 85 percent

Minor Components
Ethridge and similar soils: 0 to 7 percent
McKenzie and similar soils: 0 to 5 percent
Scobey and similar soils: 0 to 3 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Perched
Ponding: Long
Available water capacity: Mainly 9.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Nobe Series

Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Permeability: Very slow
Landform: Alluvial fans
Parent material: Alluvium
Slope range: 0 to 2 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic (calcareous), frigid Oxyaquic Ustorthents

Typical Pedon

Nobe silty clay, in an area of Marvan, wet-Nobe silty clays, 0 to 2 percent slopes, in an area of rangeland, 1,000 feet south and 200 feet east of the northwest corner of sec. 2, T. 22 N., R. 4 W.

E—0 to 1 inch; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; hard crust, hard, friable, moderately sticky, moderately plastic; few very fine roots; common very fine irregular and few very fine and fine tubular pores; slightly effervescent; very strongly alkaline; clear smooth boundary.
Bt—1 to 3 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate fine prismatic structure parting to moderate fine and medium angular and subangular blocky; hard, friable, moderately sticky, moderately plastic; few very fine roots; common very fine irregular and few very fine and fine tubular pores; slightly effervescent; very strongly alkaline; gradual smooth boundary.
By—3 to 6 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable, very sticky, very plastic; few very fine roots; common very fine irregular and few very fine and fine tubular pores; common fine masses and threads of gypsum; strongly effervescent; very strongly alkaline; gradual smooth boundary.
Byz1—6 to 20 inches; olive (5Y 5/3) silty clay, olive gray (5Y 5/2) moist; flocculated granular structure; hard, friable, very sticky, very plastic;

few very fine roots; few very fine irregular and few very fine and fine tubular pores; common fine masses and threads of gypsum and other salts; strongly effervescent; very strongly alkaline; gradual wavy boundary.

Byz2—20 to 48 inches; pale olive (5Y 6/3) silty clay, olive (5Y 5/3) moist; flocculated granular structure; very hard, firm, very sticky, very plastic; few very fine irregular and few very fine and fine tubular pores; many fine masses and threads of gypsum and other salts; strongly effervescent; very strongly alkaline; gradual wavy boundary.

Byz3—48 to 60 inches; pale olive (5Y 6/3) silty clay and silty clay loam, olive (5Y 5/3) moist; stratified; hard, firm, very sticky, very plastic; few very fine irregular pores; common fine masses and threads of gypsum and other salts; strongly effervescent; very strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Other features: In some areas, the Bt horizon is recognized as having characteristics of an argillic or cambic horizon but does not meet the minimum requirements of thickness for either one.
Depth to the Byz horizon: 5 to 16 inches

E horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 3 to 5 moist; 5 to 7 dry
Chroma: 2 or 3
Clay content: 27 to 40 percent
Electrical conductivity: 4 to 8 mmhos/cm
Sodium adsorption ratio: 5 to 13
Calcium carbonate equivalent: 1 to 5 percent
Reaction: pH 6.6 to 8.4

Bt horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 moist; 5 to 7 dry
Chroma: 2 or 3
Texture: Clay or silty clay
Clay content: 40 to 50 percent
Electrical conductivity: 4 to 8 mmhos/cm
Sodium adsorption ratio: 5 to 30
Calcium carbonate equivalent: 1 to 5 percent
Reaction: pH 6.6 to 8.4

By and Byz1 horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 moist; 5 to 7 dry
Chroma: 2 or 3
Texture: Clay, silty clay, or silty clay loam
Clay content: 35 to 60 percent
Electrical conductivity: 16 to 30 mmhos/cm
Gypsum: 1 to 6 percent
Sodium adsorption ratio: 15 to 40 percent
Calcium carbonate equivalent: 1 to 5 percent
Reaction: pH 7.9 to 10.0

Byz2 and Byz3 horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 moist; 5 to 7 dry
Chroma: 2 or 3
Texture: Clay, silty clay, or silty clay loam that is stratified with loam, clay loam, and silt loam
Clay content: 35 to 60 percent
Electrical conductivity: 16 to 30 mmhos/cm
Gypsum: 1 to 6
Sodium adsorption ratio: 15 to 70
Calcium carbonate equivalent: 1 to 5 percent
Reaction: pH 7.9 to 10.0

Nunemaker Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Very slow
Landform: Glaciated till plains
Parent material: Glacial till
Slope range: 0 to 8 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic, frigid Aridic Ustochrepts

Typical Pedon

Nunemaker silty clay loam, in an area of Nunemaker-Ethridge silty clay loams, 4 to 8 percent slopes, in an area of nonirrigated cropland, 1,600 feet north and 300 feet west of the southeast corner of sec. 7, T. 25 N., R. 3 W.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; cloddy with moderate fine granular structure; clods hard and granules slightly hard, friable, moderately sticky, moderately plastic; common fine roots; less than 5 percent pebbles; slightly effervescent; slightly alkaline; clear smooth boundary.

Bw—6 to 16 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, moderately sticky, moderately plastic; common fine roots; many fine pores; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk—16 to 33 inches; brown (2.5Y 5/3) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, moderately sticky, moderately plastic; common fine roots; many very fine and fine pores; few pebbles; common fine soft masses of lime; strongly effervescent; slightly alkaline; clear wavy boundary.

2Bky—33 to 42 inches; pale brown (2.5Y 6/3) clay loam, dark grayish brown (2.5Y 5/2) moist; massive; hard, friable, moderately sticky, moderately plastic; few very fine roots; common very fine pores; few pebbles; common fine soft masses of lime; few threads and soft masses of gypsum crystals; strongly effervescent; moderately alkaline; gradual wavy boundary.

2By—42 to 60 inches; pale brown (2.5Y 6/3) clay loam, dark grayish brown (2.5Y 5/2) moist; massive; hard, friable, moderately sticky, moderately plastic; few pebbles; common threads and soft masses of gypsum crystals; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Depth to the Bk horizon: 10 to 16 inches

Ap horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 3 or 4 moist
Chroma: 2 or 3
Clay content: 35 to 40 percent
Content of rock fragments: 0 to 5 percent pebbles
Effervescence: Slightly to strongly
Calcium carbonate equivalent: 1 to 5 percent
Reaction: pH 7.4 to 8.4

Bw horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Silty clay loam, clay, or silty clay
Clay content: 35 to 55 percent
Content of rock fragments: 0 to 5 percent pebbles
Effervescence: Slightly to strongly
Calcium carbonate equivalent: 1 to 10 percent
Reaction: pH 7.4 to 8.4

Bk horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Clay loam, silty clay loam, clay, or silty clay
Clay content: 35 to 55 percent
Content of rock fragments: 0 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 2 to 4 mmhos/cm
Reaction: pH 7.4 to 8.4

2Bky and 2By horizons
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay or clay loam (Below 40 inches, textures include sandy clay loam and loam.)
Clay content: 35 to 50 percent (Clay content is 25 to 45 percent below 40 inches.)
Content of rock fragments: 0 to 20 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Electrical conductivity: 2 to 4 mmhos/cm
Gypsum: 1 to 3 percent
Reaction: pH 7.4 to 8.4

250B—Nunemaker silty clay loam, 0 to 4 percent slopes

Setting

Landform: Till plains
Slope: 0 to 4 percent
Elevation: 3,300 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Nunemaker and similar soils: 90 percent

Minor Components
Marias and similar soils: 0 to 4 percent
Ethridge and similar soils: 0 to 3 percent
Scobey and similar soils: 0 to 2 percent
Kevin and similar soils: 0 to 1 percent

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

250C—Nunemaker silty clay loam, 4 to 8 percent slopes

Setting

Landform: Till plains
Slope: 4 to 8 percent
Elevation: 3,300 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Nunemaker and similar soils: 90 percent

Minor Components
Kevin and similar soils: 0 to 3 percent
Scobey and similar soils: 0 to 3 percent
Ethridge and similar soils: 0 to 2 percent
Marias and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

550C—Nunemaker-Marias complex, 4 to 8 percent slopes

Setting

Landform:
- Nunemaker—Till plains
- Marias—Till plains

Position on landform:
- Nunemaker—Shoulders
- Marias—Footslopes

Slope:
- Nunemaker—4 to 8 percent
- Marias—4 to 8 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Nunemaker and similar soils: 55 percent
Marias and similar soils: 35 percent

Minor Components
Ethridge and similar soils: 0 to 3 percent
Linnet and similar soils: 0 to 2 percent
McKenzie and similar soils: 0 to 2 percent
Scobey and similar soils: 0 to 2 percent
Kevin and similar soils: 0 to 1 percent

Major Component Description

Nunemaker
Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

Marias
Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits
Native plant cover type: Rangeland

Flooding: None
Available water capacity: Mainly 8.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

650C—Nunemaker-Ethridge silty clay loams, 4 to 8 percent slopes

Setting

Landform:
- Nunemaker—Till plains
- Ethridge—Till plains

Position on landform:
- Nunemaker—Shoulders
- Ethridge—Footslopes

Slope:
- Nunemaker—4 to 8 percent
- Ethridge—4 to 8 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Nunemaker and similar soils: 45 percent
Ethridge and similar soils: 40 percent

Minor Components
Marias and similar soils: 0 to 9 percent
Scobey and similar soils: 0 to 4 percent
Kevin and similar soils: 0 to 2 percent

Major Component Description

Nunemaker
Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

Ethridge
Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

Pendroy Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Very slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Very-fine, montmorillonitic, frigid Chromic Udic Haplusterts

Typical Pedon

Pendroy clay, 0 to 2 percent slopes, in an area of nonirrigated cropland, 50 feet north and 300 feet west of the southeast corner of sec. 35, T. 23 N., R. 2 E.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; very hard, friable, very sticky, very plastic; many fine and medium roots; common very fine and fine irregular pores; slightly effervescent; moderately alkaline; clear smooth boundary.

Bss1—6 to 30 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; extremely hard, firm, very sticky, very plastic; common fine roots; common very fine tubular pores; common distinct shiny grooved slickensides that intersect at a 30 to 60 degree angle; slightly effervescent; moderately alkaline; diffuse smooth boundary.

Bss2—30 to 48 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, very fine, very sticky, very plastic; common fine roots; few very fine tubular pores; many distinct shiny grooved slickensides that intersect at a 30 to 60 degree angle; slightly effervescent; moderately alkaline; diffuse smooth boundary.

BCy—48 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, very firm, very sticky, very plastic; few very fine and fine roots in cracks; few very fine tubular pores; common medium seams and masses of gypsum; slightly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to gypsum: 26 to 50 inches
Other features: When dry, these soils form cracks 1- to 4-inches wide at the surface. These cracks extend to depths of 20 inches or more where they are still 1/2-inch wide or more. A bedrock substratum phase is recognized.

Ap horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 60 to 75 percent
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 7.4 to 8.4

Bss horizons
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Clay content: 60 to 75 percent
Electrical conductivity: 2 to 4 mmhos/cm
Reaction: pH 7.4 to 8.4

BCy horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Clay content: 60 to 75 percent
Electrical conductivity: 2 to 4 mmhos/cm
Gypsum: 2 to 6 percent
Reaction: pH 7.9 to 8.4

46A—Pendroy clay, 0 to 2 percent slopes

Setting

Landform: Lake plains
Slope: 0 to 2 percent
Elevation: 3,200 to 3,800 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Pendroy and similar soils: 90 percent

Minor Components
Marias and similar soils: 0 to 8 percent
McKenzie and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

800—Pits, gravel

Composition

Major Components
Pits, gravel: 100 percent

Major Component Description

Definition: Areas mined as a source of gravel, presently supporting little or no vegetation

Pylon Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Very slow
Landform: Sedimentary plains
Parent material: Semiconsolidated shale
Slope range: 0 to 4 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic Typic Eutroboralfs

Typical Pedon

Pylon silty clay loam, 0 to 4 percent slopes, in an area of nonirrigated cropland, 20 feet south and 2,500 feet west of the northeast corner of sec. 18, T. 23 N., R. 1 E.

Ap—0 to 6 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, friable, moderately sticky, moderately plastic; common fine and medium roots; many medium vesicular pores; slightly alkaline; abrupt wavy boundary.

Bt1—6 to 9 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; strong fine columnar

structure parting to moderate medium subangular blocky; very hard, firm, moderately sticky, very plastic; common fine roots; common very fine and fine tubular pores; common distinct clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bt2—9 to 17 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; strong medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, moderately sticky, very plastic; few very fine and fine roots; common very fine and fine tubular pores; common distinct clay films on faces of peds; slightly alkaline; gradual wavy boundary.

Bk—17 to 26 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; strong medium subangular blocky structure; very hard, friable, moderately sticky, very plastic; few very fine roots; common very fine tubular pores; few fine soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bky—26 to 36 inches; light brownish gray (2.5Y 6/2) shaly silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; extremely hard, friable, moderately sticky, moderately plastic; common fine soft masses of lime; few fine threadlike seams of gypsum; 20 percent soft shale fragments; slightly effervescent; moderately alkaline; gradual wavy boundary.

Cr—36 to 60 inches; gray (N 6/) semiconsolidated platy shale; moderately acid.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Content of rock fragments: Less than 5 percent pebbles throughout
Depth to the Bk horizon: 12 to 18 inches
Depth to the Cr horizon: 20 to 40 inches

Ap horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 3 or 4 moist
Chroma: 1 or 2
Clay content: 30 to 40 percent
Reaction: pH 6.1 to 7.3

Bt horizons
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Silty clay loam, silty clay, or clay
Clay content: 35 to 55 percent
Reaction: pH 6.6 to 7.8

Bk and Bky horizons
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Silty clay loam, silty clay, or clay
Clay content: 35 to 50 percent
Electrical conductivity: 2 to 8 mmhos/cm
Reaction: pH 7.9 to 9.0

Cr horizon
Material: Semiconsolidated shale

80B—Pylon silty clay loam, 0 to 4 percent slopes

Setting

Landform: Sedimentary plains
Slope: 0 to 4 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Pylon and similar soils: 85 percent

Minor Components
Abor and similar soils: 0 to 6 percent
Creed and similar soils: 0 to 5 percent
Kobase and similar soils: 0 to 4 percent

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Raynesford Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Stream terraces
Parent material: Alluvium derived from limestone or sandstone
Slope range: 0 to 4 percent
Mean annual precipitation: 18 to 20 inches
Annual air temperature: 38 to 40 degrees F
Frost-free period: 60 to 90 days

Taxonomic Class: Fine-loamy, carbonatic Calcic Cryoborolls

Typical Pedon

Raynesford cobbly loam, in an area of Hanson-Raynesford complex, 0 to 4 percent slopes, in an area of rangeland, 250 feet north and 2,000 feet west of the southeast corner of sec. 11, T. 27 N., R. 9 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; 10 percent cobbles and 10 percent limestone pebbles; neutral clear smooth boundary.

Bw—6 to 12 inches; grayish brown (10YR 5/2) loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; 10 percent limestone pebbles; slightly effervescent; slightly alkaline; gradual wavy boundary.

Bk1—12 to 20 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; 10 percent limestone pebbles; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—20 to 28 inches; light gray (10YR 7/2) gravelly loam, pale brown (10YR 6/3) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common very fine roots; 20 percent limestone pebbles and 10 percent cobbles; many fine and medium soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

2Bk3—28 to 60 inches; light gray (10YR 7/2) very gravelly loam, pale brown (10YR 6/3) moist; massive structure; slightly hard, friable, slightly sticky, nonplastic; few very fine roots; 50 percent limestone pebbles and 10 percent cobbles; lime coats on pebbles with lime crusts on undersides of larger pebbles; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 36 to 41 degrees F
Thickness of the mollic epipedon: 12 to 16 inches
Depth to the 2Bk horizon: 24 to 40 inches

A horizon
Hue: 10YR or 2.5Y
Value: 3 or 4 dry; 1 to 3 moist
Chroma: 1 or 2
Clay content: 18 to 27 percent
Content of rock fragments: 15 to 35 percent—10 to 20 percent cobbles; 5 to 15 percent pebbles
Reaction: pH 7.4 to 8.4

Bw horizon
Hue: 10YR or 2.5Y
Value: 3 to 5 dry; 1 to 3 moist
Chroma: 1 to 3
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 7.4 to 8.4

Bk horizons
Hue: 2.5Y, 10YR, or 7.5YR
Value: 5 to 8 dry; 5 to 7 moist
Chroma: 1 to 4
Texture: Loam, clay loam, or silt loam
Clay content: 18 to 35 percent
Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent pebbles
Calcium carbonate equivalent: 40 to 50 percent
Reaction: pH 7.9 to 8.4

2Bk3 horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 7 or 8 dry; 6 or 7 moist
Chroma: 1 to 4
Texture: Loam, silt loam, or clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 35 to 60 percent—5 to 10 percent cobbles; 30 to 50 percent pebbles
Calcium carbonate equivalent: 40 to 50 percent
Reaction: pH 7.9 to 8.4

Rentsac Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Sedimentary plains
Parent material: Residuum from hard sandstone bedrock
Slope range: 0 to 8 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Loamy-skeletal, mixed (calcareous), frigid Lithic Ustorthents

Typical Pedon

Rentsac channery loam, in an area of Rootel-Rentsac complex, 0 to 4 percent slopes, in an area of rangeland, 2,000 feet south and 350 feet west of the northeast corner of sec. 3, T. 25 N., R. 6 W.

A—0 to 4 inches; grayish brown (10YR 5/2) channery loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky, nonplastic; many fine roots; many fine irregular pores; 25 percent channers; lime coats on undersides of larger rock fragments; slightly alkaline; clear smooth boundary.

Bk—4 to 14 inches; brown (10YR 5/3) very channery loam, dark brown (10YR 4/3) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky, nonplastic; many very fine and fine roots; many very fine and fine pores; 50 percent channers and 110 percent flagstones; lime crusts on undersides of larger rock fragments; strongly effervescent; slightly alkaline; abrupt wavy boundary.

R—14 inches; indurated sandstone with roots in cracks in upper few inches.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to bedrock: 10 to 20 inches

A horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 or 6 dry; 3 or 4 moist
Chroma: 2 to 4
Clay content: 7 to 18 percent
Content of rock fragments: 15 to 35 percent flagstones and channers
Reaction: pH 6.6 to 8.4

Bk horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4 or 6
Texture: Loam or sandy loam
Clay content: 7 to 18 percent
Content of rock fragments: 35 to 70 percent—0 to 35 percent flagstones and cobbles; 25 to 55 percent pebbles and channers
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: Less than 4 mmhos/cm
Reaction: pH 7.4 to 8.4

Richey Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Alluvial fans and sedimentary plains
Parent material: Alluvium
Slope range: 0 to 8 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic Aridic Haploborolls

Typical Pedon

Richey silty clay loam, 0 to 4 percent slopes, in an area of irrigated cropland, 2,600 feet south and 800 feet west of the northeast corner of sec. 9, T. 28 N., R. 3 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; hard, friable, very sticky, moderately plastic; many fine roots; many fine pores; slightly effervescent; slightly alkaline; clear smooth boundary.

Bw—7 to 16 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; very hard, firm, very sticky, moderately plastic; common very fine and fine roots; common very fine and fine tubular pores; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk1—16 to 22 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to weak medium subangular blocky; very hard, friable, very sticky, moderately plastic;

common very fine and fine roots; common very fine and fine tubular pores; common fine soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—22 to 36 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm, very sticky, moderately plastic; few very fine and fine roots; common very fine and fine tubular pores; common fine soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

By—36 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky, moderately plastic; few very fine pores; common fine threads and soft masses of gypsum crystals; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 41 to 46 degrees F
Thickness of the mollic epipedon: 7 to 10 inches
Depth to the Bk horizon: 12 to 20 inches

Ap horizon
Hue: 10YR or 2.5Y
Chroma: 2 or 3
Texture: Clay loam or silty clay loam
Clay content: 27 to 40 percent
Content of rock fragments: 0 to 5 percent pebbles
Reaction: pH 6.6 to 7.8

Bw horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Silty clay loam or silty clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 5 percent pebbles
Reaction: pH 7.9 to 9.0

Bk horizons
Hue: 10YR or 2.5Y
Value: 5 or 6 dry
Chroma: 2 or 3
Texture: Silty clay loam or silty clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 5 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 9.0

By horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry
Texture: Silty clay loam, clay loam, or silty clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 5 percent pebbles
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 7.9 to 9.0

41B—Richey silty clay loam, 0 to 4 percent slopes

Setting

Landform: Alluvial fans
Slope: 0 to 4 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Richey and similar soils: 85 percent

Minor Components
Ethridge and similar soils: 0 to 9 percent
Nunemaker and similar soils: 0 to 6 percent

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Ridgelawn Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to 26 inches; rapid below this depth
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy over sandy or sandy skeletal, mixed (calcareous), frigid Typic Ustifluvents

Typical Pedon

Ridgelawn loam, in an area of Ridgelawn-Nesda-Korchea complex, 0 to 2 percent slopes, occasionally flooded, in an area of forest land, 1,400 feet south and 100 feet west of the northeast corner of sec. 35, T. 25 N., R. 7 W.

A—0 to 8 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate medium granular structure; slightly hard, very friable, slightly sticky, nonplastic; many fine roots; many vesicular pores; slightly effervescent; slightly alkaline; clear smooth boundary.

C1—8 to 16 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky, nonplastic; common fine roots; common vesicular pores; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2—16 to 26 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky, nonplastic; common very fine and fine roots; common vesicular pores; strongly effervescent; moderately alkaline; clear wavy boundary.

2C3—26 to 32 inches; grayish brown (10YR 5/2) very gravelly loamy fine sand, dark grayish brown (10YR 4/2) moist; massive; very friable, slightly sticky, nonplastic; common very fine and fine roots; 55 percent coarse rock fragments; strongly effervescent; lime coats on upper sides and lime crusts on undersides of coarse rock fragments; moderately alkaline; clear wavy boundary.

2C4—32 to 60 inches; grayish brown (10YR 5/2) very gravelly sand, grayish brown (10YR 5/2) moist; single grain; nonsticky, nonplastic; few medium roots in upper part; 60 percent coarse rock fragments; strongly effervescent; lime coats and few thin lime crusts on undersides of larger coarse rock fragments; slightly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

A horizon
Hue: 5Y, 2.5Y, or 10YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 1 to 3
Clay content: 18 to 27 percent
Reaction: pH 6.6 to 7.8

C horizons
Hue: 5Y, 2.5Y, or 10YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 1 to 3
Texture: Loam, silt loam, or silty clay loam
Clay content: 18 to 35 percent
Reaction: pH 7.4 to 8.4

2C horizons
Hue: 5Y, 2.5Y, or 10YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 1 to 3
Texture: Fine sand, loamy fine sand, loamy sand, or sand
Clay content: 0 to 10 percent
Content of rock fragments: 10 to 35 percent pebbles
Reaction: pH 7.4 to 8.4

308A—Ridgelawn-Nesda-Korchea complex, 0 to 2 percent slopes, occasionally flooded

Setting

Landform:
- Ridgelawn—Flood plains
- Nesda—Flood plains
- Korchea—Flood plains

Slope:
- Ridgelawn—0 to 2 percent
- Nesda—0 to 2 percent
- Korchea—0 to 2 percent

Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Ridgelawn and similar soils: 40 percent
Nesda and similar soils: 25 percent
Korchea and similar soils: 20 percent

Minor Components
Straw and similar soils: 0 to 10 percent
Tetonview and similar soils: 0 to 5 percent

Major Component Description

Ridgelawn
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forest land

Flooding: Occasional
Available water capacity: Mainly 7.2 inches

Nesda
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forest land
Flooding: Occasional
Available water capacity: Mainly 3.2 inches

Korchea
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forest land
Flooding: Occasional
Available water capacity: Mainly 10.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

500—Riverwash

Composition

Major Components
Riverwash: 90 percent

Minor Components
Havre, poorly drained: 0 to 5 percent
Nesda and similar soils: 0 to 3 percent
Rivra and similar soils: 0 to 2 percent

Major Component Description

Definition: Areas of recently deposited alluvial material reworked often by flood waters. These areas support little or no vegetation.
Flooding: Frequent
Water table: Apparent

Rivra Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Very rapid below 7 inches
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Sandy-skeletal, mixed, frigid Aridic Ustifluvents

Typical Pedon

Rivra gravelly sandy loam, in an area of Rivra, occasionally flooded-Riverwash complex, 0 to 4 percent slopes, in an area of forest land, 1,100 feet south and 500 feet west of the northeast corner of sec. 5, T. 24 N., R. 5 W.

A—0 to 8 inches; brown (10YR 5/3) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, very friable, slightly sticky, nonplastic; common fine and few coarse roots; common vesicular pores; 20 percent pebbles; strongly effervescent; slightly alkaline; clear wavy boundary.
C1—8 to 29 inches; pale brown (10YR 6/3) very gravelly loamy sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky, nonplastic; few fine and medium roots; 50 percent pebbles and 10 percent cobbles; strongly effervescent; moderately alkaline; gradual wavy boundary.
C2—29 to 60 inches; pale brown (10YR 6/3) very gravelly sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky, nonplastic; few medium roots; 60 percent pebbles and 10 percent cobbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Soil phases: Rarely flooded
Other features: Thin buried A horizons do occur above 40 inches.

A horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 5 to 15 percent
Content of rock fragments: 15 to 35 percent—0 to 10 percent stones and cobbles; 15 to 25 percent pebbles
Reaction: pH 6.6 to 8.4

C horizons
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 or 3

Texture: Sand, loamy sand, and loamy coarse sand that consist of stratification of these and some finer sands
Clay content: 0 to 5 percent
Content of rock fragments: 55 to 80 percent—10 to 20 percent stones and cobbles; 45 to 70 percent pebbles
Reaction: pH 7.4 to 8.4

110B—Rivra, occasionally flooded-Riverwash complex, 0 to 4 percent slopes

Setting

Landform: Flood plains
Slope:
- Rivra—0 to 4 percent
- Riverwash—0 to 4 percent

Elevation: 3,200 to 4,400 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Rivra and similar soils: 50 percent
Riverwash: 35 percent

Minor Components
Ryell and similar soils: 0 to 10 percent
Havre and similar soils: 0 to 5 percent

Major Component Description

Rivra
Surface layer texture: Gravelly sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forest land
Flooding: Occasional
Available water capacity: Mainly 2.1 inches

Riverwash
Definition: Areas of recently deposited alluvial material reworked often by flood waters. These areas support little or no vegetation.
Flooding: Frequent
Water table: Apparent

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Rootel Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Hills and sedimentary plains
Parent material: Residuum from sandstone bedrock
Slope range: 0 to 15 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy, mixed, frigid Haplocalcidic Ustochrepts

Typical Pedon

Rootel loam, in an area of Rootel-Rentsac complex, 0 to 4 percent slopes, in an area of rangeland, 2,200 feet north and 2,300 feet west of the southeast corner of sec. 3, T. 25 N., R. 6 W.

A—0 to 3 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many fine roots; many vesicular pores; 10 percent channers; slightly effervescent; slightly alkaline; clear smooth boundary.
Bw—3 to 10 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; many fine pores; 10 percent channers; slightly effervescent; slightly alkaline; clear smooth boundary.
Bk1—10 to 18 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to weak medium subangular blocky; hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; common fine pores; 10 percent channers; common medium soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.
Bk2—18 to 28 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak medium

prismatic structure parting to weak medium subangular blocky; hard, very friable, moderately sticky, slightly plastic; common very fine and fine roots; many fine pores; 10 percent channers with lime casts on undersides; common medium soft masses of lime; violently effervescent; moderately alkaline; abrupt smooth boundary.

R—28 inches; hard sandstone, fractured in the upper few inches; lime coats between fragments.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the R horizon: 20 to 40 inches

A horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 3 or 4 moist
Chroma: 2 or 3
Clay content: 15 to 25 percent
Reaction: pH 7.4 to 7.8

Bw horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Loam or silt loam
Clay content: 18 to 27 percent
Content of rock fragments: 5 to 35 percent—0 to 5 percent flagstones; 5 to 30 percent channers
Calcium carbonate equivalent: 15 to 25 percent
Reaction: pH 7.9 to 8.4

Bk horizons
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or silt loam
Clay content: 18 to 27 percent
Content of rock fragments: 5 to 35 percent—0 to 5 percent flagstones; 5 to 30 percent channers
Calcium carbonate equivalent: 25 to 35 percent
Reaction: pH 7.9 to 9.0

177C—Rootel-Marmarth loams, 2 to 8 percent slopes

Setting

Landform:
- Rootel—Sedimentary plains
- Marmarth—Sedimentary plains

Position on landform:
- Rootel—Shoulders and summits
- Marmarth—Footslopes

Slope:
- Rootel—2 to 8 percent
- Marmarth—2 to 8 percent

Elevation: 3,600 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Rootel and similar soils: 50 percent
Marmarth and similar soils: 35 percent

Minor Components
Rentsac and similar soils: 0 to 8 percent
Cabbart and similar soils: 0 to 7 percent

Major Component Description

Rootel
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.5 inches

Marmarth
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

277B—Rootel-Rentsac complex, 0 to 4 percent slopes

Setting

Landform:
- Rootel—Sedimentary plains
- Rentsac—Sedimentary plains

Slope:
- Rootel—0 to 4 percent
- Rentsac—0 to 4 percent

Elevation: 3,600 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Rootel and similar soils: 45 percent
Rentsac and similar soils: 40 percent

Minor Components
Areas of rock outcrop: 0 to 9 percent
Marmarth and similar soils: 0 to 6 percent

Major Component Description

Rootel
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.5 inches

Rentsac
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Rothiemay Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Stream terraces, relict stream terraces, hills, alluvial fans, or sedimentary plains
Parent material: Alluvium
Slope range: 0 to 15 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy, mixed Aridic Calciborolls

Typical Pedon

Rothiemay clay loam, in an area of Varney-Rothiemay clay loams, 0 to 4 percent slopes, in an area of irrigated cropland, 600 feet north and 2,600 feet east of the southwest corner of sec. 11, T. 22 N., R. 3 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common fine and medium roots; 5 percent pebbles; many fine irregular pores; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw—8 to 16 inches; pale brown (10YR 6/3) clay loam, grayish brown (10YR 5/2) moist; moderate medium prismatic structure parting to weak fine and medium subangular blocky; hard, firm, moderately sticky, moderately plastic; common very fine and fine roots; common very fine and fine irregular pores; 5 percent pebbles; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk1—16 to 26 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, firm, moderately sticky, moderately plastic; common very fine and fine roots; common fine and medium pores; 5 percent pebbles; common fine masses and threads of segregated lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—26 to 36 inches; light gray (2.5Y 7/2) clay loam, light yellowish brown (2.5Y 6/4) moist; massive; hard, firm, moderately sticky, moderately plastic; few fine roots; few fine irregular pores; 5 percent pebbles; many fine and medium soft masses and threads of segregated lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk3—36 to 42 inches; light gray (2.5Y 7/2) clay loam, light yellowish brown (2.5Y 6/4) moist; massive; very hard, firm, moderately sticky, moderately plastic; few very fine roots; few fine irregular pores; 5 percent pebbles; few fine masses and threads of segregated lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk4—42 to 50 inches; pale olive (5Y 6/3) sandy clay loam, olive (5Y 5/3) moist; massive; slightly hard, very firm, slightly sticky, slightly plastic; few very fine roots; few fine irregular pores; 5 percent pebbles; few fine soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

BC—50 to 60 inches; olive gray (5Y 7/2) gravelly clay loam, pale olive (2.5Y 6/3) moist; massive; very hard, firm, moderately sticky, moderately plastic; few very fine roots; few fine irregular pores; 20 percent pebbles; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 10 inches
Depth to the calcic horizon: 13 to 20 inches
Soil phases: Calcareous and gravelly

Ap horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist
Chroma: 1 or 2
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent pebbles
Calcium carbonate equivalent: 1 to 10 percent
Reaction: pH 7.4 to 8.4

Bw horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 18 to 35 percent with less than 35 percent fine and coarser sand
Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent pebbles
Calcium carbonate equivalent: 5 to 20 percent
Reaction: pH 7.4 to 8.4

Bk1 and Bk2 horizons
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy clay loam
Clay content: 18 to 35 percent with less than 35 percent fine and coarser sand
Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent pebbles
Calcium carbonate equivalent: 15 to 40 percent
Reaction: pH 7.9 to 9.0

Bk3, Bk4, and BC horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy clay loam
Clay content: 18 to 35 percent with less than 35 percent fine and coarser sand
Content of rock fragments: 5 to 35 percent pebbles
Calcium carbonate equivalent: 15 to 60 percent
Reaction: pH 7.9 to 9.0

23B—Rothiemay clay loam, 0 to 4 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 4 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Rothiemay and similar soils: 85 percent

Minor Components
Niart and similar soils: 0 to 6 percent
Varney and similar soils: 0 to 4 percent
Crago and similar soils: 0 to 3 percent
Arrod and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

123B—Rothiemay-Niart clay loams, 0 to 4 percent slopes

Setting

Landform:
- Rothiemay—Stream terraces
- Niart—Stream terraces

Slope:
- Rothiemay—0 to 4 percent
- Niart—0 to 4 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Rothiemay and similar soils: 50 percent
Niart and similar soils: 35 percent

Minor Components
Arrod and similar soils: 0 to 4 percent
Crago and similar soils: 0 to 6 percent
Varney and similar soils: 0 to 5 percent

Major Component Description

Rothiemay
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.2 inches

Niart
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

223D—Rothiemay-Crago complex, 4 to 15 percent slopes

Setting

Landform:
- Rothiemay—Relict stream terraces
- Crago—Relict stream terraces

Position on landform:
- Rothiemay—Backslopes and footslopes
- Crago—Shoulders and summits

Slope:
- Rothiemay—4 to 15 percent
- Crago—4 to 15 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Rothiemay and similar soils: 55 percent
Crago and similar soils: 30 percent

Minor Components
Niart and similar soils: 0 to 7 percent
Arrod and similar soils: 0 to 5 percent
Varney and similar soils: 0 to 3 percent

Major Component Description

Rothiemay
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.2 inches

Crago
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

523B—Rothiemay gravelly clay loam, 0 to 4 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 4 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Rothiemay and similar soils: 85 percent

Minor Components
Crago and similar soils: 0 to 5 percent
Arrod and similar soils: 0 to 4 percent
Niart and similar soils: 0 to 4 percent
Varney and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Gravelly clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

523C—Rothiemay gravelly clay loam, 4 to 8 percent slopes

Setting

Landform: Stream terraces
Slope: 4 to 8 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Rothiemay and similar soils: 85 percent

Minor Components
Crago and similar soils: 0 to 7 percent
Arrod and similar soils: 0 to 4 percent
Niart and similar soils: 0 to 4 percent

Major Component Description

Surface layer texture: Gravelly clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

623C—Rothiemay-Delpoint gravelly clay loams, 2 to 8 percent slopes

Setting

Landform:
- Rothiemay—Alluvial fans
- Delpoint—Sedimentary plains

Position on landform:
- Rothiemay—Footslopes
- Delpoint—Backslopes and shoulders

Slope:
- Rothiemay—2 to 8 percent
- Delpoint—2 to 8 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Rothiemay and similar soils: 50 percent
Delpoint and similar soils: 40 percent

Minor Components
Niart and similar soils: 0 to 4 percent
Crago and similar soils: 0 to 3 percent
Kremlin and similar soils: 0 to 3 percent

Major Component Description

Rothiemay
Surface layer texture: Gravelly clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.0 inches

Delpoint
Surface layer texture: Gravelly clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

623D—Rothiemay-Delpoint gravelly clay loams, 8 to 15 percent slopes

Setting

Landform:
• Rothiemay—Alluvial fans
• Delpoint—Hills
Position on landform:
• Rothiemay—Backslopes and footslopes
• Delpoint—Shoulders
Slope:
• Rothiemay—8 to 15 percent
• Delpoint—8 to 15 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Rothiemay and similar soils: 45 percent
Delpoint and similar soils: 40 percent

Minor Components
Crago and similar soils: 0 to 6 percent
Niart and similar soils: 0 to 6 percent
Kremlin and similar soils: 0 to 3 percent

Major Component Description

Rothiemay
Surface layer texture: Gravelly clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.0 inches

Delpoint
Surface layer texture: Gravelly clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

630B—Rothiemay, calcareous-Niart gravelly clay loams, 0 to 4 percent slopes

Setting

Landform:
• Rothiemay—Stream terraces
• Niart—Stream terraces
Slope:
• Rothiemay—0 to 4 percent
• Niart—0 to 4 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Rothiemay and similar soils: 50 percent
Niart and similar soils: 35 percent

Minor Components
Arrod and similar soils: 0 to 6 percent
Crago and similar soils: 0 to 6 percent
Varney and similar soils: 0 to 3 percent

Major Component Description

Rothiemay
Surface layer texture: Gravelly clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.0 inches

Niart
Surface layer texture: Gravelly clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

630C—Rothiemay-Niart gravelly clay loams, 4 to 8 percent slopes

Setting

Landform:
- Rothiemay—Stream terraces
- Niart—Stream terraces

Position on landform:
- Rothiemay—Footslopes
- Niart—Backslopes and shoulders

Slope:
- Rothiemay—4 to 8 percent
- Niart—4 to 8 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Rothiemay and similar soils: 50 percent
Niart and similar soils: 35 percent

Minor Components
Crago and similar soils: 0 to 9 percent
Arrod and similar soils: 0 to 6 percent

Major Component Description

Rothiemay
Surface layer texture: Gravelly clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.0 inches

Niart
Surface layer texture: Gravelly clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

723B—Rothiemay-Niart gravelly clay loams, 0 to 4 percent slopes

Setting

Landform:
- Rothiemay—Stream terraces
- Niart—Stream terraces

Slope:
- Rothiemay—0 to 4 percent
- Niart—0 to 4 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Rothiemay and similar soils: 50 percent
Niart and similar soils: 35 percent

Minor Components
Crago and similar soils: 0 to 7 percent
Varney and similar soils: 0 to 5 percent
Arrod and similar soils: 0 to 3 percent

Major Component Description

Rothiemay
Surface layer texture: Gravelly clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.1 inches

Niart
Surface layer texture: Gravelly clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Roundor Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Hills
Parent material: Semiconsolidated sedimentary beds
Slope range: 2 to 60 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed Typic Calciborolls

Typical Pedon

Roundor loam, in an area of Kiev-Roundor loams, 2 to 15 percent slopes, in an area of rangeland, 1,650 feet south and 450 feet west of the northeast corner of sec. 12, T. 24 N., R. 7 W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and few medium roots; many fine vesicular pores; 5 percent pebbles; slightly effervescent; slightly alkaline; clear smooth boundary.

Bw—5 to 12 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, moderately sticky, slightly plastic; common fine roots; common very fine and fine pores; 5 percent pebbles; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk1—12 to 26 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky, slightly plastic; common fine roots; common very fine pores; 5 percent pebbles; common fine and medium soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

2Bk2—26 to 31 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; stratified parting to weak medium granular structure; hard, friable, slightly sticky, slightly plastic; few fine roots; 10 percent soft shale fragments; common fine soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Cr—31 to 60 inches; very pale brown (10YR 7/3) semiconsolidated shale; pale brown (10YR 6/3) moist; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Thickness of the mollic epipedon: 7 to 12 inches; may include the upper part of the Bw horizon.
Depth to the Cr horizon: 20 to 40 inches

A horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 18 to 27 percent

Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent pebbles
Reaction: pH 7.4 to 7.8

Bw horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 or 3
Texture: Loam, silt loam, clay loam, or silty clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 0 to 15 percent either rounded pebbles or soft shale fragments
Reaction: pH 7.4 to 8.4

Bk horizons
Hue: 2.5Y, 10YR, or 7.5YR
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Loam, silt loam, fine sandy loam, or clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 0 to 15 percent either rounded pebbles or soft shale fragments
Calcium carbonate equivalent: 15 to 35 percent
Reaction: pH 7.9 to 8.4

Ryell Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to 26 inches; rapid below this depth
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Coarse-loamy over sandy or sandy-skeletal, mixed (calcareous), frigid Aridic Ustifluvents

Typical Pedon

Ryell loam, in an area of Havre-Ryell loams, 0 to 2 percent slopes, rarely flooded, in an area of cropland, 400 feet south and 1,250 feet west of the northeast corner of sec. 14, T. 24 N., R. 5 W.

A—0 to 5 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure; soft, very friable, slightly sticky, nonplastic; many fine and few medium roots; common fine irregular pores; slightly effervescent; slightly alkaline; clear wavy boundary.

C1—5 to 16 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, very friable, slightly sticky, nonplastic; many fine and few medium roots; many fine irregular pores; strongly effervescent; slightly alkaline; clear wavy boundary.

C2—16 to 26 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, slightly sticky, nonplastic; common very fine and fine roots; common very fine and fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

2C3—26 to 60 inches; brown (10YR 5/3) extremely gravelly loamy sand, dark brown (10YR 4/3) moist; single grain, loose, nonsticky, nonplastic; few very fine and fine roots on the upper part; 55 percent pebbles and 5 percent cobbles; strongly effervescent; lime crusts on undersides of coarse rock fragments; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Depth to the 2C3 horizon: 18 to 36 inches

Ap horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 10 to 27 percent
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 7.4 to 8.4

C1 and C2 horizons
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Very fine sandy loam, loamy very fine sand, and loam consisting of very fine sandy loam with thin strata of silt loam and/or fine sandy loam
Clay content: 10 to 18 percent
Content of rock fragments: 0 to 5 percent pebbles
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 7.4 to 8.4

2C3 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3

Texture: Sand or loamy sand
Clay content: 0 to 10 percent
Content of rock fragments: 35 to 70 percent—0 to 15 percent cobbles; 35 to 55 percent pebbles
Electrical conductivity: 0 to 4 mmhos/cm
Reaction: pH 7.4 to 8.4

111A—Ryell-Rivra complex, 0 to 2 percent slopes, occasionally flooded

Setting

Landform:
• Ryell—Flood plains
• Rivra—Flood plains
Slope:
• Ryell—0 to 2 percent
• Rivra—0 to 2 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Ryell and similar soils: 50 percent
Rivra and similar soils: 35 percent

Minor Components
Areas of riverwash: 0 to 7 percent
Fairway and similar soils: 0 to 5 percent
Havre and similar soils: 0 to 3 percent

Major Component Description

Ryell
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forest land
Flooding: Occasional
Available water capacity: Mainly 5.3 inches

Rivra
Surface layer texture: Gravelly sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forest land
Flooding: Occasional
Available water capacity: Mainly 2.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

207A—Ryell-Havre loams, 0 to 2 percent slopes, occasionally flooded

Setting

Landform:
• Ryell—Flood plains
• Havre—Flood plains
Slope:
• Ryell—0 to 2 percent
• Havre—0 to 2 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Ryell and similar soils: 45 percent
Havre and similar soils: 40 percent

Minor Components
Rivra and similar soils: 0 to 6 percent
Havre, poorly drained: 0 to 5 percent
Areas of riverwash: 0 to 2 percent
Fairway and similar soils: 0 to 2 percent

Major Component Description

Ryell
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forest land
Flooding: Occasional
Available water capacity: Mainly 5.3 inches

Havre
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forest land
Flooding: Occasional
Available water capacity: Mainly 9.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

211A—Ryell-Rivra complex, 0 to 2 percent slopes, rarely flooded

Setting

Landform:
- Ryell—Flood plains
- Rivra—Flood plains

Slope:
- Ryell—0 to 2 percent
- Rivra—0 to 2 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Ryell and similar soils: 50 percent
Rivra and similar soils: 35 percent

Minor Components
Havre and similar soils: 0 to 10 percent
Fairway, poorly drained: 0 to 5 percent

Major Component Description

Ryell
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 5.3 inches

Rivra
Surface layer texture: Gravelly sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 2.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Saypo Series

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Permeability: Moderately slow
Landform: Flood plains, stream terraces, and closed depressions
Parent material: Alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 13 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 120 days

Taxonomic Class: Fine-loamy, mixed Aquic Calciborolls

Typical Pedon

Saypo clay loam, 0 to 2 percent slopes, rarely flooded, in an area of rangeland, 1,000 feet south and 1,700 feet east of the northwest corner of sec. 22, T. 26 N., R. 7 W.

(Colors are for moist soil unless otherwise noted.)

A—0 to 7 inches; very dark brown (10YR 2/2) clay loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium granular structure; slightly hard, very friable, moderately sticky, slightly plastic; many fine and few medium roots; many fine and medium pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—7 to 15 inches; light brownish gray (2.5Y 6/2) clay loam, light gray (2.5Y 7/2) dry; weak medium prismatic structure parting to moderate fine and medium granular; hard, very friable, moderately sticky, moderately plastic; common fine and few medium roots; common fine pores; few fine soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.

Bk2—15 to 25 inches; brown (10YR 5/3) clay loam, very pale brown (10YR 7/3) dry; common fine distinct yellowish brown (10YR 5/6) redox concentrations; weak medium prismatic structure parting to moderate medium granular; very hard, friable, moderately sticky, moderately plastic; few very fine and fine roots; common very fine pores; common fine soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Bk3—25 to 48 inches; dark brown (10YR 4/3) clay loam, pale brown (10YR 6/3) dry; many medium distinct yellowish brown (10YR 5/6) redox concentrations and few fine distinct gray (10YR 5/1) redox depletions; massive; very hard, friable,

moderately sticky, moderately plastic; few very fine roots; common very fine pores; 10 percent pebbles; few fine soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C—48 to 60 inches; dark brown (10YR 4/3) gravelly clay loam, pale brown (10YR 6/3) dry; many medium distinct yellowish brown (10YR 5/6) redox concentrations and common fine gray (10YR 5/1) redox depletions; massive; very hard, friable, moderately sticky, moderately plastic; 25 percent pebbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 46 degrees F
Thickness of the mollic epipedon: 7 to 12 inches
Depth to the seasonal high water table: 3 to 5 feet, except in flood-irrigated areas where it is near the surface for short periods.
Depth to the calcic horizon: 5 to 12 inches
Soil phases: Saline

A horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist; 3 or 4 dry
Chroma: 1 or 2
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 5 percent pebbles
Electrical conductivity: 0 to 12 mmhos/cm; saline phase is 4 to 12 mmhos/cm
Sodium adsorption ratio: 0 to 30; sodic phase is 13 to 30
Reaction: pH 7.4 to 9.4; saline phase is pH 8.4 to 9.4

Bk1 horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 moist; 5 to 7 dry
Chroma: 2 or 3
Texture: Clay loam or loam
Clay content: 22 to 35 percent
Content of rock fragments: 0 to 5 percent pebbles
Calcium carbonate equivalent: 20 to 25 percent
Electrical conductivity: 0 to 8 mmhos/cm; saline phase is 4 to 8 mmhos/cm
Sodium adsorption ratio: 0 to 13
Reaction: pH 7.4 to 9.0; saline phase is pH 7.9 to 9.0

Bk2 and Bk3 horizons
Hue: 10YR or 2.5Y
Value: 4 to 6 moist; 5 to 7 dry
Chroma: 2 or 3
Texture: Clay loam or loam
Clay content: 22 to 35 percent
Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent pebbles
Calcium carbonate equivalent: 30 to 35 percent
Electrical conductivity: 0 to 8 mmhos/cm; saline phase is pH 4 to 8 mmhos/cm
Sodium adsorption ratio: 0 to 13
Reaction: pH 7.9 to 9.0

C horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 or 5 moist; 5 or 6 dry
Chroma: 2 or 3
Texture: Clay loam or loam
Clay content: 22 to 40 percent
Content of rock fragments: 5 to 50 percent—0 to 10 percent cobbles; 5 to 40 percent pebbles
Electrical conductivity: 0 to 8 mmhos/cm; saline phase is pH 4 to 8 mmhos/cm
Sodium adsorption ratio: 0 to 13
Reaction: pH 7.9 to 9.0

68A—Saypo clay loam, 0 to 2 percent slopes, rarely flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 13 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Saypo and similar soils: 85 percent

Minor Components
Truchot and similar soils: 0 to 6 percent
Tetonview and similar soils: 0 to 3 percent
Niart and similar soils: 0 to 2 percent
Rothiemay and similar soils: 0 to 2 percent
Winginaw and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Available water capacity: Mainly 7.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

168A—Saypo-Truchot clay loams, 0 to 2 percent slopes, rarely flooded

Setting

Landform:
- Saypo—Flood plains
- Truchot—Flood plains

Slope:
- Saypo—0 to 2 percent
- Truchot—0 to 2 percent

Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 14 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Saypo and similar soils: 45 percent
Truchot and similar soils: 40 percent

Minor Components
Rothiemay and similar soils: 0 to 6 percent
Niart and similar soils: 0 to 4 percent
Ridgelawn and similar soils: 0 to 3 percent
Birchfield and similar soils: 0 to 2 percent

Major Component Description

Saypo
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Available water capacity: Mainly 7.8 inches

Truchot
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Available water capacity: Mainly 4.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

268A—Saypo-Tetonview complex, 0 to 2 percent slopes, rarely flooded

Setting

Landform:
- Saypo—Flood plains
- Tetonview—Flood plains

Slope:
- Saypo—0 to 2 percent
- Tetonview—0 to 2 percent

Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 13 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Saypo and similar soils: 45 percent
Tetonview and similar soils: 45 percent

Minor Components
Birchfield and similar soils: 0 to 5 percent
Truchot and similar soils: 0 to 5 percent

Major Component Description

Saypo
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Available water capacity: Mainly 7.8 inches

Tetonview
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland

Flooding: Rare
Water table: Apparent
Available water capacity: Mainly 8.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

368A—Saypo clay loam, saline, 0 to 2 percent slopes, rarely flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 3,200 to 4,600 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 100 to 120 days

Composition

Major Components
Saypo and similar soils: 85 percent

Minor Components
Trudau and similar soils: 0 to 10 percent
Tetonview and similar soils: 0 to 3 percent
Birchfield and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

468A—Saypo-Tetonview complex, saline, 0 to 2 percent slopes, rarely flooded

Setting

Landform:
- Saypo—Flood plains
- Tetonview—Flood plains

Slope:
- Saypo—0 to 2 percent
- Tetonview—0 to 2 percent

Elevation: 3,200 to 4,600 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 100 to 120 days

Composition

Major Components
Saypo and similar soils: 45 percent
Tetonview and similar soils: 45 percent

Minor Components
Birchfield and similar soils: 0 to 5 percent
Trudau and similar soils: 0 to 5 percent

Major Component Description

Saypo
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.7 inches

Tetonview
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Salt affected: Saline within 30 inches
Available water capacity: Mainly 6.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

823A—Saypo clay loam, sodic, 0 to 2 percent slopes, rarely flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 100 to 120 days

Composition

Major Components
Saypo and similar soils: 85 percent

Minor Components
Fairway and similar soils: 0 to 5 percent
Trudau and similar soils: 0 to 5 percent
Tetonview and similar soils: 0 to 3 percent
Birchfield and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

923B—Saypo-Niart clay loams, 0 to 4 percent slopes

Setting

Landform:
- Saypo—Stream terraces
- Niart—Stream terraces

Position on landform:
- Saypo—Footslopes and toeslopes
- Niart—Backslopes and shoulders

Slope:
- Saypo—0 to 2 percent
- Niart—0 to 4 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 13 to 14 inches
Frost-free period: 100 to 120 days

Composition

Major Components
Saypo and similar soils: 50 percent
Niart and similar soils: 35 percent

Minor Components
Rothiemay and similar soils: 0 to 6 percent
Truchot and similar soils: 0 to 4 percent
Trudau and similar soils: 0 to 3 percent
Birchfield and similar soils: 0 to 1 percent
Tetonview and similar soils: 0 to 1 percent

Major Component Description

Saypo
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Apparent
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.1 inches

Niart
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Scobey Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Glaciated till plains and hills
Parent material: Glacial till
Slope range: 0 to 15 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic Aridic Argiborolls

Typical Pedon

Scobey clay loam, in an area of Scobey-Kevin clay loams, 4 to 8 percent slopes, in an area of nonirrigated cropland, 1,600 feet north and 500 feet east of the southwest corner of sec. 9, T. 25 N., R. 2 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; 5 percent pebbles; neutral; gradual smooth boundary.

Bt—6 to 16 inches; light olive brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; strong fine and medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, friable, very sticky, very plastic; common very fine and fine roots; many very fine and fine tubular pores; common distinct clay films on faces of peds; 5 percent pebbles; neutral; gradual smooth boundary.

Btk—16 to 24 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium prismatic structure parting to moderate medium subangular blocky; very hard, friable, very sticky, very plastic; few very fine and fine roots; many very fine tubular pores; few faint clay films on faces of peds; 5 percent pebbles; few soft masses of segregated lime and few lime-coated pebbles; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk—24 to 42 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse prismatic structure; hard, friable, very sticky, very plastic; few very fine roots; common very fine tubular pores; 5 percent pebbles; common soft masses of segregated lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cy—42 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, friable, very sticky, very plastic; few pebbles; common threadlike masses and seams of gypsum accumulated in cracks; slightly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to the Btk horizon: 10 to 18 inches
Depth to the Cy horizon: 30 to 55 inches
Other features: These soils have air dry bulk density greater than 1.35 g/cm^3 above 40 inches and a moist bulk density greater than 1.35 g/cm^3 at depths as shallow as 20 inches.

Ap horizon
Hue: 10YR or 2.5Y
Chroma: 2 or 3
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 15 percent pebbles
Reaction: pH 6.1 to 7.8

Bt horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 2 to 4
Texture: Clay loam or clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; trace to 10 percent pebbles
Reaction: pH 6.6 to 8.4

Btk and Bk horizons
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Clay content: 30 to 40 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; trace to 10 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

Cy horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Clay content: 30 to 40 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; trace to 10 percent pebbles
Calcium carbonate equivalent: 5 to 12 percent
Sodium adsorption ratio: 1 to 8

Gypsum: 1 to 6 percent
Reaction: pH 7.4 to 9.0

164B—Scobey-Kevin clay loams, 0 to 4 percent slopes

Setting

Landform:
- Scobey—Till plains
- Kevin—Till plains

Position on landform:
- Scobey—Footslopes and toeslopes
- Kevin—Backslopes and footslopes

Slope:
- Scobey—0 to 4 percent
- Kevin—0 to 4 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Scobey and similar soils: 50 percent
Kevin and similar soils: 35 percent

Minor Components
Nishon and similar soils: 0 to 5 percent
Hillon and similar soils: 0 to 4 percent
Ethridge and similar soils: 0 to 3 percent
Kobase and similar soils: 0 to 2 percent
McKenzie and similar soils: 0 to 1 percent

Major Component Description

Scobey
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

Kevin
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

263C—Scobey-Kevin clay loams, 4 to 8 percent slopes

Setting

Landform:
- Scobey—Till plains
- Kevin—Till plains

Position on landform:
- Scobey—Footslopes
- Kevin—Backslopes and shoulders

Slope:
- Scobey—4 to 8 percent
- Kevin—4 to 8 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Scobey and similar soils: 45 percent
Kevin and similar soils: 40 percent

Minor Components
Hillon and similar soils: 0 to 9 percent
Joplin and similar soils: 0 to 3 percent
Nishon soils: 0 to 2 percent
McKenzie and similar soils: 0 to 1 percent

Major Component Description

Scobey
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

Kevin
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained

Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

264B—Scobey-Acel complex, 0 to 4 percent slopes

Setting

Landform:
• Scobey—Till plains
• Acel—Till plains
Position on landform:
• Scobey—Footslopes
• Acel—Toeslopes
Slope:
• Scobey—0 to 4 percent
• Acel—0 to 4 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Scobey and similar soils: 55 percent
Acel and similar soils: 30 percent

Minor Components
Kevin and similar soils: 0 to 8 percent
Ethridge and similar soils: 0 to 5 percent
Nishon soils: 0 to 2 percent

Major Component Description

Scobey
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

Acel
Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciofluvial deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

364D—Scobey-Hillon clay loams, 2 to 15 percent slopes

Setting

Landform:
• Scobey—Hills
• Hillon—Hills
Position on landform:
• Scobey—Footslopes
• Hillon—Backslopes and shoulders
Slope:
• Scobey—2 to 15 percent
• Hillon—2 to 15 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Scobey and similar soils: 55 percent
Hillon and similar soils: 30 percent

Minor Components
Kevin and similar soils: 0 to 10 percent
Ethridge and similar soils: 0 to 3 percent
Nishon and similar soils: 0 to 2 percent

Major Component Description

Scobey
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till

Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

Hillon
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Scravo Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate to 10 inches; rapid below this depth
Landform: Stream terraces and relict stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Sandy-skeletal, mixed, frigid Haplocalcidic Ustochrepts

Typical Pedon

Scravo gravelly loam, 0 to 4 percent slopes, in an area of nonirrigated cropland, 1,600 feet north and 1,800 feet east of the southwest corner of sec. 26, T. 30 N., R. 7 W.

A—0 to 5 inches; grayish brown (10YR 5/2) gravelly loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many fine roots; many fine irregular pores; 25 percent pebbles; lime coats on undersides of larger coarse rock fragments; slightly effervescent; slightly alkaline; clear smooth boundary.

Bk1—5 to 10 inches; light brownish gray (10YR 6/2) very gravelly loam, grayish brown (10YR 5/2) moist; moderate medium granular structure; slightly hard, very friable, nonsticky, nonplastic; many fine roots; 50 percent cobbles and 5 percent pebbles; lime coats on undersides of larger cobbles and pebbles; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—10 to 15 inches; light brownish gray (10YR 6/2) extremely gravelly sandy loam, brown (10YR 5/3) moist; single grain; nonsticky, nonplastic; common fine roots; 55 percent pebbles and 10 percent cobbles; lime coats on all surfaces with lime crusts on undersides of larger coarse rock fragments; violently effervescent; moderately alkaline; gradual wavy boundary.

2C—15 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly loamy sand, brown (10YR 5/3) moist; single grain; nonsticky, nonplastic; few fine roots; 65 percent pebbles and 10 percent cobbles; lime coats on all surfaces with lime crusts on undersides of larger coarse rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Depth to the Bk horizon: 3 to 6 inches
Depth to the 2C horizon: 9 to 20 inches

A horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Clay content: 15 to 25 percent
Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles; 15 to 30 percent pebbles
Calcium carbonate equivalent: 1 to 15 percent
Reaction: pH 7.4 to 7.8

Bk horizons
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Sandy loam or loam
Clay content: 5 to 15 percent
Content of rock fragments: 35 to 70 percent—0 to 15 percent cobbles; 35 to 55 percent pebbles
Electrical conductivity: 0 to 2 mmhos/cm
Calcium carbonate equivalent: 15 to 40 percent
Reaction: pH 7.9 to 8.4

2C horizon
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Loamy sand or sand

Clay content: 0 to 10 percent
Content of rock fragments: 35 to 80 percent—0 to 15 percent cobbles; 35 to 65 percent pebbles
Electrical conductivity: 0 to 2 mmhos/cm
Calcium carbonate equivalent: 10 to 30 percent
Reaction: pH 7.9 to 8.4

218B—Scravo gravelly loam, 0 to 4 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 4 percent
Elevation: 3,500 to 3,900 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Scravo and similar soils: 90 percent

Minor Components
Binna and similar soils: 0 to 10 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Sebud Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountain slopes
Parent material: Colluvium from glacial till
Slope range: 4 to 35 percent
Mean annual precipitation: 19 to 24 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 60 to 90 days

Taxonomic Class: Loamy-skeletal, mixed Typic Cryoborolls

Typical Pedon

Sebud stony loam, in an area of Adel-Burnette-Sebud complex, 4 to 35 percent slopes, in an area of forest land, 150 feet south and 150 feet west of the northeast corner of sec. 31, T. 28 N., R. 9 W.

Oi—1 inch to 0; organic mat.
A—0 to 4 inches; dark grayish brown (10YR 4/2) stony loam, black (10YR 2/1) moist; weak medium granular structure; soft, friable, nonsticky, slightly plastic; many fine and few coarse roots; many fine vesicular pores; 15 percent stones and 10 percent pebbles; neutral; clear smooth boundary.
Bw1—4 to 10 inches; dark grayish brown (10YR 4/2) stony loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common fine and few coarse roots; common fine vesicular pores; 30 percent stones and cobbles; neutral; clear wavy boundary.
Bw2—10 to 20 inches; brown (7.5YR 5/2) stony sandy clay loam, dark brown (7.5YR 4/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, moderately plastic; common fine and few coarse roots; common fine vesicular pores; 15 percent stones and 15 percent pebbles; neutral; gradual wavy boundary.
C—20 to 60 inches; brown (7.5YR 5/2) very cobbly sandy clay loam, dark brown (7.5YR 4/2)) moist; massive; slightly hard, friable, slightly sticky, moderately plastic; few coarse roots; 35 percent stones and cobbles and 15 percent pebbles; neutral.

Range in Characteristics

Soil temperature: 36 to 46 degrees F
Thickness of the mollic epipedon: 10 to 16 inches

A horizon
Hue: 2.5Y or 10YR
Value: 3 or 4 dry; 2 or 3 moist
Chroma: 1 to 3
Clay content: 15 to 27 percent
Content of rock fragments: 15 to 35 percent—5 to 15 percent stones; 10 to 20 percent pebbles
Content of rock fragments, surface cover: 0 to 3 percent stones
Reaction: pH 6.6 to 7.8

Bw and C horizons
Hue: 2.5Y, 10YR, or 7.5YR
Value: 4 to 7 dry; 3 to 5 moist
Chroma: 2 to 4
Texture: Clay loam, sandy clay loam, and coarse sandy loam
Clay content: 15 to 35 percent
Content of rock fragments: 35 to 60 percent—30 to 45 percent stones or cobbles; 5 to 15 percent pebbles
Reaction: pH 6.6 to 7.8

Shambo Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans
Parent material: Alluvium
Slope range: 2 to 15 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed Typic Haploborolls

Typical Pedon

Shambo loam, in an area of Shambo-Amor loams, 8 to 15 percent slopes, in an area of rangeland, 1,100 feet north and 1,200 feet east of the southwest corner of sec. 14, T. 27 N., R. 7 W.

A—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure in the upper part grading to moderate medium granular in the lower part; slightly hard, friable, slightly sticky, slightly plastic; many fine roots; many very fine and fine vesicular pores; neutral; clear smooth boundary.

Bw1—7 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; many fine roots; common fine pores; slightly alkaline; clear smooth boundary.

Bw2—13 to 18 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, moderately plastic; many fine roots; common very fine and fine pores; slightly alkaline; gradual wavy boundary.

Bk1—18 to 24 inches; light brownish gray (2.5Y 6/2) clay loam, brown (2.5Y 5/3) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky, moderately plastic; common fine roots; common very fine and fine pores; few fine soft masses of lime; 5 percent pebbles; strongly effervescent; slightly alkaline; gradual wavy boundary.

Bk2—24 to 30 inches; light gray (2.5Y 6/2) clay loam, olive (5Y 5/3) moist; moderate medium subangular blocky structure; very hard, firm, moderately sticky, moderately plastic; few fine roots; few very fine pores; many fine and medium soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk3—30 to 48 inches; pale yellow (5Y 7/3) clay loam, light yellowish brown (5Y 6/4) moist; moderate medium subangular blocky structure; very hard, firm, moderately sticky, moderately plastic; few fine soft masses of lime; violently effervescent; strongly alkaline; clear wavy boundary.

C—48 to 60 inches; pale olive (5Y 6/3) loam, olive (5Y 5/3) moist; massive; hard, friable, slightly sticky, slightly plastic; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to the Bk horizon: 14 to 32 inches

A horizon
Hue: 10YR
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 10 to 27 percent
Reaction: pH 6.6 to 7.8

Bw horizons
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 2 to 4
Texture: Loam, silt loam, or clay loam
Clay content: 18 to 35 percent
Reaction: pH 6.6 to 8.4

Bk horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, clay loam, silty clay loam, or silt loam
Content of rock fragments: 0 to 5 percent pebbles
Clay content: 18 to 35 percent
Calcium carbonate equivalent: 10 to 15 percent
Reaction: pH 7.4 to 9.0

C horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or loam stratified with sandy loam, fine sandy loam, very fine sandy loam, silty clay loam, sandy clay loam, and clay loam
Reaction: pH 7.4 to 9.0

384C—Shambo-Amor loams, 2 to 8 percent slopes

Setting

Landform:
- Shambo—Alluvial fans
- Amor—Sedimentary plains

Position on landform:
- Shambo—Footslopes
- Amor—Backslopes and shoulders

Slope:
- Shambo—2 to 8 percent
- Amor—2 to 8 percent

Elevation: 3,800 to 4,800 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Shambo and similar soils: 45 percent
Amor and similar soils: 40 percent

Minor Components
Kiev and similar soils: 0 to 7 percent
Roundor and similar soils: 0 to 5 percent
Fairfield and similar soils: 0 to 3 percent

Major Component Description

Shambo
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.9 inches

Amor
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

384D—Shambo-Amor loams, 8 to 15 percent slopes

Setting

Landform:
- Shambo—Alluvial fans
- Amor—Hills

Position on landform:
- Shambo—Backslopes and footslopes
- Amor—Shoulders and summits

Slope:
- Shambo—8 to 15 percent
- Amor—8 to 15 percent

Elevation: 3,800 to 4,800 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Shambo and similar soils: 45 percent
Amor and similar soils: 40 percent

Minor Components
Kiev and similar soils: 0 to 7 percent
Cabba and similar soils: 0 to 4 percent
Roundor and similar soils: 0 to 4 percent

Major Component Description

Shambo
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.9 inches

Amor
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained

Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Shawmut Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Relict stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 105 days

Taxonomic Class: Loamy-skeletal, mixed Typic Argiborolls

Typical Pedon

Shawmut gravelly loam, in an area of Shawmut-Windham gravelly loams, 0 to 4 percent slopes, in an area of nonirrigated cropland, 500 feet north and 400 feet east of the southwest corner of sec. 6, T. 23 N., R. 7 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many medium irregular pores; 20 percent pebbles; neutral; clear smooth boundary.

Bt—6 to 10 inches; brown (10YR 4/3) gravelly clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to strong fine subangular blocky; hard, very friable, slightly sticky, moderately plastic; many very fine and fine roots; many fine and medium irregular pores; common distinct clay films on faces of peds; 25 percent pebbles and 5 percent cobbles; neutral; clear smooth boundary.

Bk1—10 to 14 inches; brown (10YR 5/3) very gravelly clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, very friable, slightly sticky, moderately plastic; common very fine and fine roots; common fine irregular pores; 45 percent limestone pebbles and 5 percent cobbles; lime crusts on undersides of rock fragments; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—14 to 24 inches; pale brown (10YR 6/3) very gravelly clay loam, brown (10YR 5/3) moist; massive; hard, very friable, slightly sticky, moderately plastic; few very fine roots; few very fine irregular pores; 45 percent limestone pebbles and 5 percent cobbles; lime crusts on undersides of rock fragments; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk3—24 to 60 inches; pale brown (10YR 6/3) extremely gravelly sandy clay loam, brown (10YR 5/3) moist; massive; hard, very friable, slightly sticky, moderately plastic; few very fine roots; few very fine irregular pores; 55 percent pebbles and 5 percent cobbles; lime crusts on undersides of rock fragments; violently effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to the calcic horizon: 9 to 20 inches

Ap horizon
Hue: 7.5YR or 10YR
Value: 3 or 4 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 15 to 27 percent
Content of rock fragments: 15 to 35 percent—0 to 10 percent cobbles; 15 to 25 percent pebbles
Reaction: pH 6.6 to 7.3

Bt horizon
Hue: 7.5YR or 10YR
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 2 or 3
Texture: Sandy clay loam or clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 15 to 80 percent—0 to 15 percent stones; 0 to 20 percent cobbles; 15 to 45 percent pebbles
Reaction: pH 6.6 to 7.3

Bk1 horizon
Hue: 2.5Y or 10YR
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Sandy loam, clay loam, or loam
Clay content: 15 to 30 percent

Content of rock fragments: 35 to 80 percent—0 to 20 percent stones; 0 to 20 percent cobbles; 30 to 75 percent pebbles
Calcium carbonate equivalent: 15 to 30 percent
Reaction: pH 7.9 to 8.4

Bk2 and Bk3 horizons
Hue: 2.5Y or 10YR
Value: 5 to 8 dry; 4 to 7 moist
Chroma: 2 or 3
Texture: Sandy loam, loam, or sandy clay loam
Clay content: 5 to 25 percent
Content of rock fragments: 50 to 85 percent—0 to 20 percent stones; 0 to 20 percent cobbles; 45 to 70 percent pebbles
Calcium carbonate equivalent: 10 to 25 percent
Electrical conductivity: Less than 2 mmhos/cm
Reaction: pH 7.9 to 9.0

126B—Shawmut-Windham gravelly loams, 0 to 4 percent slopes

Setting

Landform:
- Shawmut—Relict stream terraces
- Windham—Relict stream terraces

Slope:
- Shawmut—0 to 4 percent
- Windham—0 to 4 percent

Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 105 days

Composition

Major Components
Shawmut and similar soils: 50 percent
Windham and similar soils: 40 percent

Minor Components
Judith and similar soils: 0 to 5 percent
Kiev and similar soils: 0 to 3 percent
Utica and similar soils: 0 to 2 percent

Major Component Description

Shawmut
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.1 inches

Windham
Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Shedhorn Series

Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Permeability: Slow
Landform: Mountains
Parent material: Alluvium
Slope range: 0 to 8 percent
Mean annual precipitation: 19 to 22 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 60 to 90 days

Taxonomic Class: Fine, mixed Typic Cryoborolls

Typical Pedon

Shedhorn clay loam, in an area of Adel-Gallatin-Shedhorn complex, 0 to 8 percent slopes, in an area of forest land, 1,350 feet south and 1,850 feet west of the northeast corner of sec. 20, T. 27 N., R. 8 W.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, moderately sticky, moderately plastic; many very fine and common fine roots; common very fine vesicular pores; slightly acid; clear smooth boundary.

A2—6 to 15 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable, moderately sticky, moderately plastic; many very fine and common fine roots; common very fine vesicular pores; neutral; gradual smooth boundary.

Bw—15 to 30 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; common very fine and fine roots; common very fine and fine vesicular pores; 5 percent pebbles; slightly alkaline; gradual wavy boundary.

C—30 to 60 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, firm, moderately sticky, moderately plastic; few very fine and fine roots; few fine vesicular pores; 10 percent pebbles; slightly alkaline.

Range in Characteristics

Soil temperature: 36 to 40 degrees F
Thickness of the mollic epipedon: 12 to 16 inches
Depth to the seasonal high water table: 48 to 60 inches

A horizons
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 3 moist
Chroma: 1 or 2
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 15 percent shale and sandstone fragments—trace cobbles; 0 to 15 percent pebbles
Reaction: pH 6.1 to 6.5

Bw horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 1 or 2
Texture: Clay loam or clay
Clay content: 35 to 45 percent
Content of rock fragments: 5 to 35 percent shale and sandstone fragments—0 to 5 percent cobbles; 5 to 30 percent pebbles
Reaction: pH 6.1 to 7.3

C horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 to 4
Texture: Clay loam or clay
Clay content: 35 to 45 percent
Content of rock fragments: 10 to 35 percent mainly shale fragments—0 to 5 percent flagstones; 10 to 30 percent channers
Reaction: pH 6.1 to 7.8
Other features: Colors are lithochromic, varying with the color of the parent material.

Starley Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountain slopes
Parent material: Limestone bedrock
Slope range: 15 to 70 percent
Mean annual precipitation: 20 to 24 inches
Annual air temperature: 38 to 41 degrees F
Frost-free period: 55 to 75 days

Taxonomic Class: Loamy-skeletal, mixed Lithic Cryoborolls

Typical Pedon

Starley stony loam, in an area of Whitore-Starley, stony loams, 15 to 45 percent slopes, in an area of forest land, 200 feet south and 1,200 feet east of the northwest corner of sec. 29, T. 25 N., R. 8 W.

A—0 to 6 inches; dark grayish brown (10YR 5/2) stony loam, very dark brown (10YR 2/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots; 10 percent flagstones and 15 percent channers; slightly alkaline; gradual wavy boundary.

Bw—6 to 15 inches; dark brown (10YR 4/3) very channery loam, dark brown (10YR 3/3) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; 35 percent channers and 20 percent stones or flagstones; slightly effervescent; slightly alkaline; clear smooth boundary.

R—15 inches; fractured limestone bedrock.

Range in Characteristics

Soil temperature: 36 to 40 degrees F
Thickness of the mollic epipedon: 12 to 16 inches

A horizon
Hue: 7.5YR, 10YR, 2.5Y, or 5Y
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 to 3
Clay content: 15 to 27 percent
Content of rock fragments: 15 to 35 percent—10 to 15 percent stones or flagstones; 5 to 20 percent channers
Reaction: pH 6.6 to 8.4

Bw horizon
Hue: 7.5YR, 10YR, 2.5Y, or 5Y
Value: 4 to 8 dry; 3 to 5 moist
Chroma: 2 to 4
Clay content: 18 to 35 percent
Content of rock fragments: 35 to 70 percent—10 to 20 percent flagstones; 25 to 50 percent channers
Reaction: pH 7.9 to 9.0

291F—Starley-Rock outcrop-Rubble land complex, 25 to 70 percent slopes

Setting

Landform: Mountains
Slope:
- Starley—25 to 70 percent
- Rock outcrop—25 to 70 percent
- Rubble land—25 to 70 percent

Elevation: 5,000 to 6,300 feet
Mean annual precipitation: 20 to 24 inches
Frost-free period: 55 to 75 days

Composition

Major Components
Starley and similar soils: 50 percent
Rock outcrop: 20 percent
Rubble land: 15 percent

Minor Components
Whitore and similar soils: 0 to 8 percent
Hanson and similar soils: 0 to 7 percent

Major Component Description

Starley
Surface layer texture: Stony loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.5 inches

Rock outcrop
Definition: Limestone or sandstone bedrock

Rubble land
Definition: Areas having more than 90 percent of the surface area covered by boulders or stones of limestone and sandstone, with little or no vegetation

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Straw Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed Cumulic Haploborolls

Typical Pedon

Straw loam, in an area of Korchea-Straw loams, 0 to 2 percent slopes, rarely flooded, in an area of native grass-hay meadowland, 50 feet south and 1,500 feet east of the northwest corner of sec. 25, T. 23 N., R. 7 W.

A1—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many vesicular pores; slightly effervescent; slightly alkaline; clear wavy boundary.

A2—8 to 18 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; many fine irregular pores; strongly effervescent; slightly alkaline; clear wavy boundary.

C1—18 to 36 inches; light brownish gray (10YR 6/2) loam with thin lenses of silt loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; common very fine irregular pores; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—36 to 60 inches; light brownish gray (10YR 6/2) stratified fine sandy loam and loam, dark grayish brown (10YR 4/2) moist; few fine distinct dark yellowish brown (10YR 4/6) mottles; massive; slightly hard, very friable, slightly sticky, nonplastic; few very fine roots in upper part; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 16 to 36 inches

A horizons
Hue: 10YR or 2.5Y
Value: 3 or 4 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 22 to 27 percent
Content of rock fragments: 0 to 10 percent pebbles
Calcium carbonate equivalent: 0 to 5 percent
Reaction: pH 6.6 to 8.4

C horizons
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam, silt loam, or clay loam stratified with sandy loam or fine sandy loam
Clay content: 22 to 35 percent
Content of rock fragments: 0 to 10 percent pebbles
Calcium carbonate equivalent: 3 to 15 percent
Reaction: pH 7.4 to 8.4

Tanna Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Sedimentary plains
Parent material: Semiconsolidated shale
Slope range: 0 to 8 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine, montmorillonitic Aridic Argiborolls

Typical Pedon

Tanna clay loam, in an area of Tanna clay loam, 0 to 4 percent slopes, in an area of nonirrigated cropland, 1,000 feet south and 1,200 feet east of the northwest corner of sec. 19, T. 24 N., R. 2 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common fine roots; many fine irregular pores; neutral; clear smooth boundary.

Bt—6 to 11 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; strong medium prismatic structure parting to moderate medium subangular blocky; slightly hard, firm, moderately sticky, moderately plastic; common very fine and fine roots; common very fine tubular pores; common distinct clay films on faces of peds; slightly alkaline; clear smooth boundary.

Bk—11 to 25 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to weak medium subangular blocky; hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; common very fine and fine pores; few medium soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bky—25 to 35 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak medium and coarse prismatic structure; very hard, firm, very sticky, very plastic; few very fine roots; few very fine pores; 15 percent weathered shale chips; common medium soft masses of lime; common fine soft threads of gypsum; violently effervescent; moderately alkaline; clear wavy boundary.

Cr—35 to 60 inches; grayish brown (2.5Y 5/2) semiconsolidated shale with thin strata of hard shale and sandstone, dark grayish brown (2.5Y 4/2) moist; few fine soft masses of lime and gypsum in upper few inches; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Thickness of the mollic epipedon: 7 to 12 inches; includes part of the argillic horizon.
Depth to the Bk horizon: 10 to 20 inches
Depth to the Cr horizon: 20 to 40 inches

Ap horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist
Chroma: 2 or 3
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 10 percent—0 to 5 percent cobbles; 0 to 5 percent channers
Reaction: pH 6.6 to 7.8

Bt horizon
Hue: 10YR or 2.5Y
Value: 3 or 4 moist
Chroma: 2 or 3
Texture: Clay loam, silty clay loam, clay, or silty clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 10 percent—0 to 5 percent cobbles; 0 to 5 percent channers
Electrical conductivity: Less than 4 mmhos/cm
Reaction: pH 6.6 to 8.4

Bk horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Clay loam, silty clay loam, or clay
Clay content: 35 to 45 percent
Content of rock fragments: 0 to 10 percent—0 to 5 percent cobbles; 0 to 5 percent channers
Electrical conductivity: 2 to 4 mmhos/cm
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

Bky horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 1 to 4
Texture: Loam, clay loam, clay, or silty clay loam
Clay content: 15 to 30 percent
Content of rock fragments: 0 to 60 percent—0 to 5 percent cobbles; 10 to 55 percent channers
Electrical conductivity: 2 to 4 mmhos/cm
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 8.4

Cr horizon
Material: Semiconsolidated shale

82B—Tanna clay loam, 0 to 4 percent slopes

Setting

Landform: Sedimentary plains
Slope: 0 to 4 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Tanna and similar soils: 85 percent

Minor Components
Ethridge and similar soils: 0 to 8 percent
Megonot and similar soils: 0 to 7 percent

Major Component Description

Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Telstad Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Glaciated till plains
Parent material: Glacial till
Slope range: 0 to 8 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy, mixed Aridic Argiborolls

Typical Pedon

Telstad loam, in an area of Telstad-Joplin loams, 0 to 4 percent slopes, in an area of nonirrigated cropland, 2,200 feet south and 250 feet east of the northwest corner of sec. 17, T. 26 N., R. 3 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky, slightly plastic; common fine and medium roots; common fine irregular pores; neutral; clear smooth boundary.
Bt—7 to 14 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium

prismatic structure parting to moderate fine and medium angular and subangular blocky; hard, friable, moderately sticky, moderately plastic; common fine and medium roots; common fine tubular pores; few pebbles; common faint clay films; neutral; gradual smooth boundary.

Bk1—14 to 20 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, moderately sticky, moderately plastic; few fine roots; many fine tubular pores; few pebbles; common soft masses of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk2—20 to 42 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure; hard, friable, moderately sticky, moderately plastic; few very fine and fine roots; few pebbles; many soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—42 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, moderately sticky, moderately plastic; few lignite fragments; few pebbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 15 inches
Depth to the Bk horizon: 10 to 20 inches

Ap horizon
Hue: 10YR or 2.5Y
Chroma: 2 or 3
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Reaction: pH 6.6 to 7.8

Bt horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 25 to 35 percent
Content of rock fragments: 0 to 10 percent—0 to 2 percent cobbles; 0 to 8 percent pebbles
Reaction: pH 6.6 to 8.4

Bk1 horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 20 to 32 percent
Content of rock fragments: 0 to 10 percent—0 to 2 percent cobbles; 0 to 8 percent pebbles
Electrical conductivity: 2 to 4 mmhos/cm
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 8.4

Bk2 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 20 to 32 percent
Content of rock fragments: 0 to 10 percent—0 to 2 percent cobbles; 0 to 8 percent pebbles
Calcium carbonate equivalent: 5 to 12 percent
Electrical conductivity: 2 to 4 mmhos/cm
Air dry bulk density: 1.7 g/cm^3 or more
Reaction: pH 7.9 to 8.4

C horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 20 to 32 percent
Content of rock fragments: 0 to 10 percent—0 to 2 percent cobbles; 0 to 8 percent pebbles
Electrical conductivity: 2 to 4 mmhos/cm
Gypsum: 0 to 3 percent
Air dry bulk density: 1.7 g/cm^3 or more
Reaction: pH 7.4 to 9.0

162C—Telstad-Joplin loams, 4 to 8 percent slopes

Setting

Landform:
- Telstad—Till plains
- Joplin—Till plains

Position on landform:
- Telstad—Footslopes
- Joplin—Backslopes and shoulders

Slope:
- Telstad—4 to 8 percent
- Joplin—4 to 8 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Telstad and similar soils: 50 percent
Joplin and similar soils: 40 percent

Minor Components
Evanston and similar soils: 0 to 3 percent
Hillon and similar soils: 0 to 3 percent
Kevin and similar soils: 0 to 2 percent
Nishon and similar soils: 0 to 2 percent

Major Component Description

Telstad
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

Joplin
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

165B—Telstad-Joplin loams, 0 to 4 percent slopes

Setting

Landform:
• Telstad—Till plains
• Joplin—Till plains
Position on landform:
• Telstad—Toeslopes
• Joplin—Backslopes and footslopes
Slope:
• Telstad—0 to 4 percent
• Joplin—0 to 4 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Telstad and similar soils: 50 percent
Joplin and similar soils: 35 percent

Minor Components
Chinook and similar soils: 0 to 5 percent
Kremlin and similar soils: 0 to 5 percent
Hillon and similar soils: 0 to 3 percent
Nishon and similar soils: 0 to 2 percent

Major Component Description

Telstad
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.9 inches

Joplin
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Teton Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountain slopes
Parent material: Hard sandstone residuum
Slope range: 4 to 35 percent

Mean annual precipitation: 18 to 21 inches
Annual air temperature: 38 to 42 degrees F
Frost-free period: 60 to 90 days

Taxonomic Class: Fine-loamy, mixed Typic Cryoborolls

Typical Pedon

Teton cobbly loam, in an area of Teton-Tibson-Cheadle complex, 4 to 35 percent slopes, in an area of rangeland, 600 feet south and 800 feet west of the northeast corner of sec. 7, T. 24 N., R. 8 W.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) cobbly loam, black (10YR 2/1) moist; moderate fine granular structure; slightly hard, very friable, nonsticky, nonplastic; many fine and common medium roots; neutral; gradual smooth boundary.

A2—6 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, very friable, nonsticky, nonplastic; many fine roots; 10 percent channers; neutral; gradual smooth boundary.

Bw—12 to 20 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; 10 percent pebbles; slightly alkaline; gradual wavy boundary.

C—20 to 30 inches; pale brown (10YR 6/3) channery loam, dark brown (10YR 4/3) moist; massive; hard, friable, slightly sticky, slightly plastic; common very fine roots; 25 percent channers; slightly effervescent; slightly alkaline.

R—30 inches; indurated fractured sandstone bedrock.

Range in Characteristics

Soil temperature: 40 to 44 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to bedrock: 20 to 40 inches

A horizons
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 1 to 3
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent pebbles
Reaction: pH 6.1 to 7.3

Bw horizon
Hue: 10YR or 7.5YR
Value: 5 or 6 dry; 3 to 5 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent pebbles
Reaction: pH 6.1 to 7.3

C horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy loam
Clay content: 18 to 35 percent
Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles; 0 to 25 percent pebbles or channers
Reaction: pH 6.6 to 8.4

196E—Teton-Tibson-Cheadle complex, 4 to 35 percent slopes

Setting

Landform:
- Teton—Mountains
- Tibson—Mountains
- Cheadle—Mountains

Position on landform:
- Teton—Shoulders and summits
- Tibson—Backslopes and footslopes
- Cheadle—Shoulders and summits

Slope:
- Teton—4 to 35 percent
- Tibson—4 to 35 percent
- Cheadle—4 to 35 percent

Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 18 to 21 inches
Frost-free period: 60 to 90 days

Composition

Major Components
Teton and similar soils: 30 percent
Tibson and similar soils: 30 percent
Cheadle and similar soils: 25 percent

Minor Components
Whitore and similar soils: 0 to 9 percent
Babb and similar soils: 0 to 6 percent

Major Component Description

Teton
Surface layer texture: Cobbly loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.0 inches

Tibson
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.2 inches

Cheadle
Surface layer texture: Stony loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Tetonview Series

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Flood plains and stream terraces
Parent material: Alluvium
Slope range: 0 to 2 percent
Mean annual precipitation: 13 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 120 days

Taxonomic Class: Fine-loamy, frigid Typic Calciaquolls

Typical Pedon

Tetonview loam, 0 to 2 percent slopes, in an area of irrigated native grass hayland, 850 feet south and 2,300 feet west of the northeast corner of sec. 22, T. 25 N., R. 6 W.

(Colors are for moist soil unless otherwise noted.)

Oi—2 inches to 0; partially decomposed fibers and roots of sedges and rushes.

A1—0 to 7 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; slightly hard, very friable, moderately sticky, slightly plastic; many fine and medium roots; common fine irregular tubular pores; slightly effervescent; slightly alkaline; clear smooth boundary.

A2—7 to 12 inches; very dark gray (10YR 3/1) clay loam, gray (10YR 5/1) dry; moderate medium granular structure; slightly hard, friable, moderately sticky, moderately plastic; common fine roots; common fine irregular tubular pores; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bkg1—12 to 26 inches; grayish brown (10YR 5/2) clay loam, light gray (10YR 7/2) dry; few fine distinct yellowish brown (10YR 5/4) redox concentrations; moderate medium granular structure; hard, firm, moderately sticky, moderately plastic; common very fine roots; common medium soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bkg2—26 to 36 inches; grayish brown (10YR 5/2) clay loam, light gray (10YR 7/2) dry; common fine distinct yellowish brown (10YR 5/4) redox concentrations; massive; hard, firm, moderately sticky, moderately plastic; few fine roots; few medium soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bkg3—36 to 60 inches; grayish brown (10YR 5/2) gravelly clay loam, light gray (10YR 7/2) dry; common medium prominent yellowish brown (10YR 5/4) redox concentrations; massive; very hard, firm, moderately sticky, moderately plastic; 15 percent rounded pebbles; few fine soft masses of lime; lime coats on undersides of rock fragments; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Depth to the seasonal high water table: 1 to 2 feet
Depth to the calcic horizon: 7 to 13 inches
Soil phases: Saline
Thickness of the mollic epipedon: 7 to 16 inches

Oi horizon
Material: Mat of organic and fibrous materials

A1 horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist; 3 or 4 dry
Chroma: 1 or 2
Clay content: 20 to 27 percent
Content of rock fragments: 0 to 5 percent pebbles
Calcium carbonate equivalent: 1 to 5 percent
Electrical conductivity: 0 to 12 mmhos/cm; saline phase is 4 to 12 mmhos/cm
Reaction: pH 6.6 to 7.8

A2 horizon
Hue: 10YR or 2.5Y
Value: 2 or 3 moist; 4 or 5 dry
Chroma: 1 or 2
Texture: Loam, clay loam, or silt loam
Clay content: 20 to 30 percent
Content of rock fragments: 0 to 5 percent pebbles
Calcium carbonate equivalent: 15 to 35 percent
Electrical conductivity: 0 to 12 mmhos/cm; saline phase is 4 to 12 mmhos/cm
Reaction: pH 7.4 to 8.4

Bkg1 horizon
Hue: 10YR or 2.5Y
Value: 3 to 6 moist; 5 to 7 dry
Texture: Loam, clay loam, silt loam
Clay content: 20 to 35 percent
Redox features: None to common, faint to prominent redox concentrations
Content of rock fragments: 0 to 10 percent pebbles
Calcium carbonate equivalent: 15 to 35 percent
Electrical conductivity: 0 to 8 mmhos/cm; saline phase is 4 to 8 mmhos/cm
Reaction: pH 7.9 to 8.4

Bkg2 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 moist; 6 or 7 dry
Texture: Loam, clay loam, or silt loam
Clay content: 20 to 35 percent
Redox features: None to common, faint to many redox concentrations
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 15 to 35 percent
Electrical conductivity: 0 to 8 mmhos/cm; saline phase is 4 to 8 mmhos/cm
Reaction: pH 7.9 to 8.4

Bkg3 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 moist; 6 or 7 dry
Texture: Loam, clay loam, sandy clay loam, or silt loam
Clay content: 20 to 30 percent
Redox features: None to common, faint to many redox concentrations
Content of rock fragments: 5 to 35 percent—0 to 5 percent cobbles; 5 to 30 percent pebbles
Calcium carbonate equivalent: 15 to 30 percent
Electrical conductivity: 0 to 8 mmhos/cm; saline phase is 4 to 8 mmhos/cm
Reaction: pH 7.9 to 8.4

55A—Tetonview loam, 0 to 2 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 2 percent
Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Tetonview and similar soils: 85 percent

Minor Components
Truchot and similar soils: 0 to 6 percent
Saypo and similar soils: 0 to 4 percent
Winginaw and similar soils: 0 to 3 percent
Birchfield and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Apparent
Available water capacity: Mainly 8.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

119A—Tetonview-Birchfield complex, 0 to 2 percent slopes

Setting

Landform:
- Tetonview—Stream terraces
- Birchfield—Stream terraces

Slope:
- Tetonview—0 to 2 percent
- Birchfield—0 to 2 percent

Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Tetonview and similar soils: 45 percent
Birchfield and similar soils: 40 percent

Minor Components
Kiev and similar soils: 0 to 5 percent
Windham and similar soils: 0 to 5 percent
Winginaw and similar soils: 0 to 5 percent

Major Component Description

Tetonview
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Apparent
Available water capacity: Mainly 8.9 inches

Birchfield
Surface layer texture: Mucky peat
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Apparent
Available water capacity: Mainly 7.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Tibson Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Mountain slopes
Parent material: Alpine till
Slope range: 4 to 45 percent
Mean annual precipitation: 18 to 22 inches
Annual air temperature: 18 to 21 degrees F
Frost-free period: 60 to 90 days

Taxonomic Class: Loamy-skeletal, mixed Calcic Cryoborolls

Typical Pedon

Tibson cobbly loam, in an area of Babb-Tibson-Adel complex, 4 to 35 percent slopes, in an area of rangeland, 2,500 feet south and 800 feet east of the northwest corner of sec. 4, T. 24 N., R. 8 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) cobbly loam, black (10YR 2/1) moist; moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine and common medium roots; common very fine irregular pores; 10 percent cobbles and 10 percent pebbles; slightly alkaline; clear wavy boundary.

Bw—4 to 8 inches; dark brown (10YR 3/3) cobbly loam, very dark brown (10YR 2/2) moist; moderate fine prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; common very fine irregular pores; 10 percent cobbles and 10 percent pebbles; slightly effervescent; gradual wavy boundary.

Bk1—8 to 14 inches; pale brown (10YR 6/3) very cobbly clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; friable, slightly sticky, moderately plastic; common very fine and fine roots; common fine tubular pores; 20 percent pebbles and 15 percent cobbles;

common medium soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—14 to 60 inches; pale brown (10YR 6/3) very cobbly clay loam, brown (10YR 5/3) moist; weak coarse prismatic structure; very hard, friable, slightly sticky, moderately plastic; common very fine roots to 42 inches and few very fine roots below this depth; 30 percent pebbles and 20 percent cobbles; common medium soft masses of lime; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 37 to 45 degrees F
Thickness of the mollic epipedon: 7 to 12 inches
Depth to the calcic horizon: 6 to 12 inches

A horizon
Value: 3 or 4 dry; 2 or 3 moist
Chroma: 1 or 2
Clay content: 18 to 27 percent
Content of rock fragments: 15 to 30 percent—0 to 15 percent stones and cobbles; 10 to 15 percent pebbles
Reaction: pH 7.4 to 8.4

Bw horizon
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 18 to 27 percent
Content of rock fragments: 5 to 65 percent—0 to 20 percent stones and cobbles; 5 to 45 percent pebbles
Reaction: pH 7.4 to 8.4

Bk1 horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam, clay loam, or sandy clay loam
Clay content: 18 to 30 percent
Calcium carbonate equivalent: 20 to 35 percent
Content of rock fragments: 35 to 60 percent—0 to 25 percent stones and cobbles; 20 to 50 percent pebbles
Reaction: pH 7.9 to 8.4

Bk2 horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy clay loam
Clay content: 18 to 30 percent
Calcium carbonate equivalent: 15 to 40 percent
Content of rock fragments: 35 to 60 percent—0 to 25 percent stones and cobbles; 20 to 50 percent pebbles
Moist bulk density: 1.8 g/cm^3
Reaction: pH 7.9 to 8.4

Truchot Series

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Permeability: Moderately slow
Landform: Stream terraces and flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Mean annual precipitation: 13 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 120 days

Taxonomic Class: Loamy-skeletal, mixed Aquic Calciborolls

Typical Pedon

Truchot clay loam, 0 to 2 percent slopes, in an area of rangeland, 2,000 feet south and 2,500 feet west of the northeast corner of sec. 14, T. 26 N., R. 8 W.

(Colors are for moist soil unless otherwise noted.)

A—0 to 7 inches; very dark brown (10YR 2/2) clay loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; hard, friable, slightly sticky, moderately plastic; many fine and medium roots; many fine and medium pores; 5 percent pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—7 to 12 inches; dark grayish brown (10YR 4/2) gravelly clay loam, light grayish brown (10YR 5/2) dry; few fine faint yellowish brown (10YR 5/4) redox concentrations; weak fine subangular blocky structure; hard, friable, slightly sticky, moderately plastic; many fine and few medium roots; many fine and medium pores; 25 percent pebbles; few medium soft masses of lime; lime coats on rock fragments; violently effervescent; moderately alkaline; clear smooth boundary.

Bk2—12 to 16 inches; brown (10YR 5/3) very gravelly clay loam, pale brown (10YR 6/3) dry; common fine distinct yellowish brown (10YR 5/6) redox concentrations; weak fine subangular blocky structure; very hard, friable, slightly sticky, moderately plastic; few fine and medium roots; common very fine and fine pores; 50 percent pebbles and 5 percent cobbles; thick lime coats on undersides and common soft masses of lime between rock fragments; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk3—16 to 26 inches; dark brown (10YR 4/3) extremely gravelly clay loam, pale brown (10YR 6/3) dry; few fine faint yellowish brown (10YR 5/6) redox concentrations; massive; very hard, friable, slightly sticky, moderately plastic; few fine and medium roots; few very fine and fine pores; 55 percent pebbles and 5 percent cobbles; thick lime coats on undersides and few soft masses of lime between fragments; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk4—26 to 60 inches; dark brown (10YR 4/3) extremely gravelly sandy clay loam, pale brown (10YR 6/3) dry; massive; hard, friable, slightly sticky, moderately plastic; few fine and medium roots in upper part; 60 percent pebbles and 5 percent cobbles; lime coats on rock fragments; violently effervescent; water table at 40 inches; moderately alkaline.

Range in Characteristics

Soil temperature: 41 to 46 degrees F
Thickness of the mollic epipedon: 7 to 10 inches
Depth to the seasonal high water table: 36 to 60 inches
Depth to the Bk horizon: 5 to 15 inches
Soil phases: Saline

A horizon
Value: 2 or 3 moist; 3 or 4 dry
Chroma: 1 or 2
Clay content: 27 to 35 percent
Content of rock fragments: 0 to 30 percent—0 to 5 percent cobbles; 0 to 25 percent pebbles
Electrical conductivity: 0 to 12 mmhos/cm; saline phase 4 to 12 mmhos/cm
Sodium adsorption ratio: 0 to 30; sodic phase is 13 to 30
Reaction: pH 7.4 to 9.4

Bk1 horizon
Hue: 10YR or 2.5Y
Value: 3 or 4 moist; 5 or 6 dry
Chroma: 1 to 3
Texture: Loam or clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles; 15 to 30 percent pebbles
Calcium carbonate equivalent: 10 to 25 percent
Electrical conductivity: 0 to 8 mmhos/cm; saline phase is 4 to 8 mmhos/cm
Reaction: pH 7.9 to 9.0

Bk2 horizon
Hue: 10YR or 2.5Y
Value: 4 to 7 moist; 6 to 8 dry
Chroma: 1 to 3
Texture: Loam or clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 25 to 60 percent—0 to 10 percent cobbles; 25 to 50 percent pebbles
Calcium carbonate equivalent: 15 to 30 percent
Electrical conductivity: 0 to 8 mmhos/cm; saline phase is 4 to 8 mmhos/cm
Reaction: pH 7.9 to 9.0

Bk3 horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 moist; 6 to 8 dry
Chroma: 1 to 3
Texture: Loam or clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 35 to 65 percent—5 to 10 percent cobbles; 30 to 55 percent pebbles
Calcium carbonate equivalent: 15 to 35 percent
Electrical conductivity: 0 to 8 mmhos/cm; saline phase is 4 to 8 mmhos/cm
Reaction: pH 7.9 to 9.0

Bk4 horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 moist; 6 or 7 dry
Chroma: 2 to 4
Texture: Sandy loam, sandy clay loam, loam, or clay loam
Clay content: 15 to 30 percent
Content of rock fragments: 45 to 80 percent—5 to 10 percent cobbles; 40 to 70 percent pebbles
Calcium carbonate equivalent: 10 to 30 percent
Electrical conductivity: 0 to 8 mmhos/cm; saline phase is 4 to 8 mmhos/cm
Reaction: pH 7.9 to 9.0

56A—Truchot clay loam, 0 to 2 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 2 percent
Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 14 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Truchot and similar soils: 85 percent

Minor Components
Saypo and similar soils: 0 to 6 percent
Rothiemay and similar soils: 0 to 5 percent

Niart and similar soils: 0 to 2 percent
Tetonview and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Apparent
Available water capacity: Mainly 4.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

156A—Truchot-Saypo clay loams, 0 to 2 percent slopes, rarely flooded

Setting

Landform:
- Truchot—Flood plains
- Saypo—Flood plains

Slope:
- Truchot—0 to 2 percent
- Saypo—0 to 2 percent

Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 100 to 120 days

Composition

Major Components
Truchot and similar soils: 45 percent
Saypo and similar soils: 40 percent

Minor Components
Rothiemay and similar soils: 0 to 6 percent
Havre and similar soils: 0 to 5 percent
Niart and similar soils: 0 to 4 percent

Major Component Description

Truchot
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 5.3 inches

Saypo
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

356A—Truchot-Tetonview-Saypo complex, 0 to 2 percent slopes, rarely flooded

Setting

Landform:
- Truchot—Flood plains
- Tetonview—Flood plains
- Saypo—Flood plains

Slope:
- Truchot—0 to 2 percent
- Tetonview—0 to 2 percent
- Saypo—0 to 2 percent

Elevation: 3,800 to 4,600 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 100 to 120 days

Composition

Major Components
Truchot and similar soils: 35 percent
Tetonview and similar soils: 30 percent
Saypo and similar soils: 20 percent

Minor Components
Trudau and similar soils: 0 to 10 percent
Birchfield and similar soils: 0 to 5 percent

Major Component Description

Truchot
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 4.8 inches

Tetonview
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Available water capacity: Mainly 8.9 inches

Saypo
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Water table: Apparent
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Trudau Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans
Parent material: Alluvium
Slope range: 0 to 8 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy, mixed, frigid Aridic Ustochrepts

Typical Pedon

Trudau loam, 0 to 4 percent slopes, in an area of pasture, 150 feet south and 350 feet east of the northwest corner of sec. 19, T. 23 N., T. 3 W.

A—0 to 6 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many fine roots; many very fine and fine vesicular pores; slightly effervescent; moderately alkaline; clear smooth boundary.

Bz—6 to 13 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to weak medium subangular blocky; hard, very friable, slightly sticky, slightly plastic; many fine roots; many fine pores; common fine soft masses of salts; strongly effervescent; strongly alkaline; clear smooth boundary.

Bkz—13 to 28 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to weak medium blocky; hard, friable, slightly sticky, slightly plastic; common fine roots; common fine pores; common fine soft masses of salts; common medium soft masses of lime; strongly effervescent; strongly alkaline; clear wavy boundary.

C1—28 to 48 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; massive; hard, friable, moderately sticky, moderately plastic; few fine roots; few fine pores; few fine salt crystals; strongly effervescent; strongly alkaline; clear wavy boundary.

C2—48 to 60 inches; grayish brown (10YR 5/2) gravelly clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, moderately sticky, moderately plastic; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

A horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 3 to 5 moist
Chroma: 2 or 3

Clay content: 20 to 27 percent
Content of rock fragments: 0 to 5 percent pebbles
Electrical conductivity: 0 to 2 mmhos/cm
Calcium carbonate equivalent: 1 to 10 percent
Reaction: pH 7.4 to 9.0; pH 7.4 to 7.8 (reclaimed)

Bz horizon
Hue: 10YR or 2.5Y
Value: 6 or 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 0 to 5 percent pebbles
Electrical conductivity: 1 to 16 mmhos/cm; less than 4 mmhos/cm (reclaimed)
Sodium adsorption ratio: Less than 5
Calcium carbonate equivalent: 1 to 10 percent
Reaction: pH 7.4 to 9.0; pH 7.4 to 8.4 (reclaimed)

Bkz horizon
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 5 to 7 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 0 to 15 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 2 to 16 mmhos/cm; less than 8 mmhos/cm (reclaimed)
Sodium adsorption ratio: 2 to 13
Reaction: pH 7.4 to 9.0

C horizons
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 7 moist
Chroma: 2 to 4
Texture: Mainly loam stratified with sandy loam, silt loam, or clay loam
Clay content: 18 to 27 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Electrical conductivity: 2 to 16 mmhos/cm; less than 8 mmhos/cm (reclaimed)
Sodium adsorption ratio: 2 to 13
Reaction: pH 7.4 to 9.0

222B—Trudau loam, 0 to 4 percent slopes

Setting

Landform: Alluvial fans
Slope: 0 to 4 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Trudau and similar soils: 85 percent

Minor Components
Saypo and similar soils: 0 to 8 percent
Kremlin and similar soils: 0 to 5 percent
Tetonview and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 9.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Twilight Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Hills and sedimentary plains
Parent material: Semiconsolidated sandy sedimentary beds
Slope range: 2 to 25 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Coarse-loamy, mixed, frigid Aridic Ustochrepts

Typical Pedon

Twilight fine sandy loam, in an area of Twilight-Yetull-Rock outcrop complex, 8 to 25 percent slopes, in an area of rangeland, 650 feet south and 1,400 feet east of the northwest corner of sec. 13, T. 28 N., R. 5 W.

A—0 to 4 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine and medium granular structure; slightly hard, very

friable, nonsticky, nonplastic; many fine and few medium roots; many very fine and fine vesicular pores; slightly effervescent; slightly alkaline; clear smooth boundary.

Bw—4 to 11 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak medium granular; slightly hard, very friable, nonsticky, nonplastic; many fine and few medium roots; common fine pores; few fine soft masses of lime in lower part; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk—11 to 22 inches; light gray (10YR 7/2) fine sandy loam, light brownish gray (10YR 6/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky, nonplastic; common fine roots; few fine pores; 5 percent channers, mostly sandstone fragments; common medium and large soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Cr1—22 to 30 inches; light gray (10YR 7/2) slightly indurated sandstone that has loamy fine sand in cracks and between plates; few fine roots in soil and between plates; common soft masses of lime on underside of plates; abrupt wavy boundary.

Cr2—30 to 60 inches; semiconsolidated sandstone.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Bk horizon: 10 to 20 inches
Depth to the Cr horizon: 20 to 40 inches

A horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 3 or 4 moist
Chroma: 2 or 3
Clay content: 5 to 18 percent
Reaction: pH 6.6 to 7.8

Bw horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Fine sandy loam or sandy loam
Clay content: 5 to 18 percent
Reaction: pH 6.6 to 7.8

Bk horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 1 to 4
Texture: Fine sandy loam or sandy loam
Clay content: 5 to 18 percent
Content of rock fragments: 5 percent channers
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

181E—Twilight-Yetull-Rock outcrop complex, 8 to 25 percent slopes

Setting

Landform:
- Twilight—Hills
- Yetull—Hills

Position on landform:
- Twilight—Backslopes and shoulders
- Yetull—Backslopes and footslopes

Slope:
- Twilight—8 to 25 percent
- Yetull—8 to 25 percent
- Rock outcrop—8 to 25 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Twilight and similar soils: 35 percent
Yetull and similar soils: 30 percent
Rock outcrop: 20 percent

Minor Components
Chinook and similar soils: 0 to 6 percent
Rentsac and similar soils: 0 to 5 percent
Assinniboine and similar soils: 0 to 4 percent

Major Component Description

Twilight
Surface layer texture: Fine sandy loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, sandy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.1 inches

Yetull
Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Alluvium or eolian material
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.6 inches

Rock outcrop
Definition: Sandstone bedrock
Surface layer texture: Unweathered bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

281C—Twilight-Chinook-Yetull complex, 2 to 8 percent slopes

Setting

Landform:
- Twilight—Sedimentary plains
- Chinook—Sedimentary plains
- Yetull—Sedimentary plains

Position on landform:
- Twilight—Backslopes and footslopes
- Chinook—Footslopes
- Yetull—Backslopes and footslopes

Slope:
- Twilight—2 to 8 percent
- Chinook—2 to 8 percent
- Yetull—2 to 8 percent

Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Twilight and similar soils: 35 percent
Chinook and similar soils: 30 percent
Yetull and similar soils: 20 percent

Minor Components
Assinniboine and similar soils: 0 to 9 percent
Rentsac and similar soils: 0 to 6 percent

Major Component Description

Twilight
Surface layer texture: Fine sandy loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, sandy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.1 inches

Chinook
Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or eolian material
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.2 inches

Yetull
Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Alluvium or eolian material
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

381C—Twilight-Rentsac complex, 2 to 8 percent slopes

Setting

Landform:
- Twilight—Sedimentary plains
- Rentsac—Sedimentary plains

Slope:
- Twilight—2 to 8 percent
- Rentsac—2 to 8 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Twilight and similar soils: 50 percent
Rentsac and similar soils: 40 percent

Minor Components
Chinook and similar soils: 0 to 7 percent
Assinniboine and similar soils: 0 to 3 percent

Major Component Description

Twilight
Surface layer texture: Fine sandy loam
Depth class: Moderately deep (20 to 40 inches)

Drainage class: Well drained
Dominant parent material: Semiconsolidated, sandy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.1 inches

Rentsac
Surface layer texture: Channery loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

700—Urban land

Composition

Major Components
Urban land: 100 percent

Major Component Description

Definition: Areas dominated by development including buildings and streets with remaining soil areas highly disturbed

Utica Series

Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Permeability: Rapid
Landform: Relict stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Sandy-skeletal, carbonatic Typic Calciborolls

Typical Pedon

Utica very gravelly loam, in an area of Utica-Windham very gravelly loams, 0 to 4 percent slopes, in an area of rangeland, 2,450 feet north and 1,450 feet west of the southeast corner of sec. 30, T. 25 N., R. 7 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky, nonplastic; many very fine and fine roots; many fine and medium interstitial pores; 30 percent pebbles and 5 percent cobbles; slightly effervescent; slightly alkaline; clear smooth boundary.

Bk—4 to 11 inches; brown (10YR 5/3) very gravelly sandy loam, dark brown (10YR 4/3) moist; massive; soft, friable, nonsticky, nonplastic; common very fine and fine roots; few fine irregular pores; common lime crusts on undersides of cobbles and pebbles; 50 percent pebbles and 5 percent cobbles; violently effervescent; moderately alkaline; clear smooth boundary.

2C—11 to 60 inches; light gray (10YR 7/2) extremely gravelly loamy sand, brown (10YR 5/3) moist; single grain; few very fine and fine roots; many lime crusts on cobbles and pebbles; 55 percent pebbles and 15 percent cobbles; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 10 inches
Depth to the calcic horizon: 5 to 10 inches

A horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 10 to 20 percent
Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles; 15 to 30 percent pebbles
Reaction: pH 7.4 to 8.4

Bk horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Clay content: 5 to 10 percent
Content of rock fragments: 25 to 60 percent—0 to 10 percent cobbles; 25 to 50 percent pebbles

Calcium carbonate equivalent: 35 to 60 percent
Reaction: pH 7.9 to 9.0

2C horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Sand or loamy sand
Clay content: 0 to 5 percent
Content of rock fragments: 50 to 80 percent—10 to 20 percent cobbles; 40 to 60 percent pebbles
Calcium carbonate equivalent: 40 to 60 percent
Reaction: pH 7.9 to 9.0

128B—Utica-Windham very gravelly loams, 0 to 4 percent slopes

Setting

Landform:
- Utica—Relict stream terraces
- Windham—Relict stream terraces

Slope:
- Utica—0 to 4 percent
- Windham—0 to 4 percent

Elevation: 4,000 to 4,800 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Utica and similar soils: 50 percent
Windham and similar soils: 40 percent

Minor Components
Judith and similar soils: 0 to 7 percent
Kiev and similar soils: 0 to 3 percent

Major Component Description

Utica
Surface layer texture: Very gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.1 inches

Windham
Surface layer texture: Very gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Vanda Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Very slow
Landform: Alluvial fans and hills
Parent material: Alluvium
Slope range: 0 to 15 percent
Mean annual precipitation: 11 to 17 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 90 to 125 days

Taxonomic Class: Fine, montmorillonitic (calcareous), frigid Aridic Ustorthents

Typical Pedon

Vanda clay, in an area of Vanda-Marvan clays, 0 to 2 percent slopes, in an area of rangeland, 2,300 feet north and 150 feet west of the southeast corner of sec. 29, T. 23 N., R. 1 E.

A—0 to 3 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong fine and medium granular structure; very hard, firm, very sticky, moderately plastic; common very fine and fine roots; few fine pores; thin light brownish gray (2.5Y 6/2) vesicular crust 1/4-inch thick on surface; slightly effervescent; strongly alkaline; clear wavy boundary.

C—3 to 10 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky, moderately plastic; few very fine and fine roots; few very fine tubular pores; strongly effervescent; strongly alkaline; gradual wavy boundary.

Cy1—10 to 24 inches; light olive (5Y 6/3) silty clay, olive gray (5Y 5/2) moist; massive; very hard, firm, moderately sticky, moderately plastic; few very fine and fine roots; few very fine and fine pores; common very fine soft masses of gypsum crystals; strongly effervescent; strongly alkaline; gradual wavy boundary.

Cy2—24 to 40 inches; light olive (5Y 6/3) clay, olive gray (5Y 5/2) moist; massive; very hard, firm, moderately sticky, moderately plastic; few very fine roots; few very fine and fine pores; few very fine soft masses of gypsum crystals; strongly effervescent; strongly alkaline; gradual wavy boundary.

Cyz—40 to 60 inches; olive (5Y 5/3) clay, olive (5Y 4/2) moist; massive; extremely hard, very firm, very sticky, very plastic; few fine threads of gypsum and few soft masses of salts; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

A horizon

Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 1 to 3
Clay content: 40 to 60 percent
Electrical conductivity: 2 to 8 mmhos/cm
Sodium adsorption ratio: 20 to 30
Reaction: pH 7.9 to 9.6

C and Cy horizons

Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Clay, silty clay, or silty clay loam
Clay content: 35 to 60 percent
Hardness: Very hard or extremely hard
Electrical conductivity: 8 to 16 mmhos/cm
Sodium adsorption ratio: 13 to 30
Reaction: pH 7.9 to 9.6

Cyz horizon

Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Clay, silty clay, or silty clay loam
Clay content: 35 to 60 percent
Hardness: Very hard or extremely hard
Gypsum: 1 to 5 percent
Electrical conductivity: 8 to 16 mmhos/cm
Sodium adsorption ratio: 13 to 30
Gypsum: 1 to 5 percent
Reaction: pH 7.9 to 9.6

160A—Vanda-Marvan clays, 0 to 2 percent slopes

Setting

Landform:
- Vanda—Alluvial fans
- Marvan—Alluvial fans

Slope:
- Vanda—0 to 2 percent
- Marvan—0 to 2 percent

Elevation: 3,200 to 3,800 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Vanda and similar soils: 60 percent
Marvan and similar soils: 30 percent

Minor Components
Gerdrum and similar soils: 0 to 5 percent
Nobe and similar soils: 0 to 3 percent
Lardell and similar soils: 0 to 2 percent

Major Component Description

Vanda
Surface layer texture: Clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.0 inches

Marvan
Surface layer texture: Clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Lacustrine deposits
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Varney Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Mean annual precipitation: 12 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy, mixed Aridic Argiborolls

Typical Pedon

Varney clay loam, in an area of Varney-Rothiemay clay loams, 0 to 4 percent slopes, in an area of irrigated cropland, 700 feet south and 2,400 feet east of the northwest corner of sec. 2, T. 22 N., R. 2 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; slightly hard, friable, moderately sticky, slightly plastic; common fine roots; common fine vesicular pores; neutral; clear smooth boundary.

Bt—6 to 10 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium angular blocky; hard, friable, moderately sticky, moderately plastic; common fine roots; common very fine and fine pores; common distinct clay films on faces of peds; 5 percent pebbles; neutral; clear wavy boundary.

Bk1—10 to 22 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; common very fine and fine pores; few fine soft masses of lime; strongly effervescent; slightly alkaline; clear wavy boundary.

Bk2—22 to 36 inches; light gray (10YR 7/2) clay loam, pale brown (10YR 6/3) moist; weak coarse prismatic structure; very hard, friable, moderately sticky, slightly plastic; few very fine and fine roots; few very fine pores; 5 percent pebbles; many large soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Bk3—36 to 48 inches; very pale brown (10YR 7/3) sandy clay loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky, moderately plastic; few very fine roots; few very fine pores; 5 percent pebbles; common fine and medium soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

BC—48 to 60 inches; very pale brown (10YR 7/3) gravelly sandy clay loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky, moderately plastic; 30 percent pebbles; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to the Bk horizon: 9 to 20 inches

Ap horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 27 to 30 percent
Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles; 0 to 30 percent pebbles
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 6.6 to 7.3

Bt horizon
Hue: 10YR or 2.5Y
Value: 4 to 6 dry; 3 to 5 moist
Chroma: 2 to 4
Texture: Clay loam or sandy clay loam
Clay content: 27 to 35 percent
Content of rock fragments: 5 to 35 percent—0 to 10 percent cobbles; 5 to 30 percent pebbles
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 6.6 to 7.8

Bk1 horizon
Hue: 10YR or 2.5Y
Value: 5 to 8 dry; 4 to 7 moist
Chroma: 2 to 4
Texture: Sandy loam, loam, clay loam, or sandy clay loam
Clay content: 10 to 30 percent
Content of rock fragments: 5 to 35 percent—0 to 5 percent cobbles; 5 to 30 percent pebbles
Calcium carbonate equivalent: 15 to 30 percent
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 7.4 to 8.4

Bk2 and Bk3 horizons
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 7 moist
Chroma: 2 to 4
Texture: Sandy loam, loam, sandy clay loam, or clay loam
Clay content: 10 to 30 percent
Content of rock fragments: 5 to 35 percent—0 to 5 percent cobbles; 5 to 30 percent pebbles
Calcium carbonate equivalent: 15 to 30 percent
Electrical conductivity: 0 to 2 mmhos/cm
Reaction: pH 7.4 to 8.4

BC horizon
Hue: 2.5Y, 10YR, or 7.5YR
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Clay content: 10 to 30 percent
Content of rock fragments: 5 to 35 percent—0 to 5 percent cobbles; 5 to 30 percent pebbles
Electrical conductivity: 0 to 2 mmhos/cm
Calcium carbonate equivalent: 5 to 25 percent
Reaction: pH 7.9 to 8.4

124B—Varney-Rothiemay clay loams, 0 to 4 percent slopes

Setting

Landform:
• Varney—Stream terraces
• Rothiemay—Stream terraces
Slope:
• Varney—0 to 4 percent
• Rothiemay—0 to 4 percent
Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Varney and similar soils: 50 percent
Rothiemay and similar soils: 40 percent

Minor Components
Niart and similar soils: 0 to 7 percent
Crago and similar soils: 0 to 3 percent

Major Component Description

Varney
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.5 inches

Rothiemay
Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

224B—Varney-Rothiemay gravelly clay loams, 0 to 4 percent slopes

Setting

Landform:
• Varney—Stream terraces
• Rothiemay—Stream terraces
Slope:
• Varney—0 to 4 percent
• Rothiemay—0 to 4 percent
Elevation: 3,600 to 4,200 feet
Mean annual precipitation: 12 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Varney and similar soils: 50 percent
Rothiemay and similar soils: 40 percent

Minor Components
Niart and similar soils: 0 to 7 percent
Crago and similar soils: 0 to 3 percent

Major Component Description

Varney
Surface layer texture: Gravelly clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.4 inches

Rothiemay
Surface layer texture: Gravelly clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Wabek Series

Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Permeability: Very rapid
Landform: Stream terraces
Parent material: Alluvium
Slope range: 0 to 8 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Sandy-skeletal, mixed Entic Haploborolls

Typical Pedon

Wabek gravelly loam, in an area of Attewan-Wabek complex, 0 to 8 percent slopes, in an area of rangeland, 600 feet north and 400 feet west of the southeast corner of sec. 3, T. 29 N., R. 2 W.

A—0 to 5 inches; grayish brown (10YR 5/2) gravelly loam, dark brown (10YR 3/2) moist; weak fine granular structure; slightly hard; very friable, slightly sticky, slightly plastic; many fine roots; 20 percent pebbles; slightly alkaline; clear wavy boundary.

Bk—5 to 10 inches; light brownish gray (10YR 6/2) very gravelly sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky, nonplastic; many very fine roots; 35 percent pebbles with lime crusts on undersides; strongly effervescent; moderately alkaline; diffuse wavy boundary.

2C—10 to 60 inches; pale brown (10YR 6/3) very gravelly loamy coarse sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky, nonplastic; common fine roots in upper part; 55 percent pebbles with lime crusts on undersides of larger pebbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Thickness of the mollic epipedon: 7 to 14 inches
Depth to the Bk horizon: 4 to 9 inches
Depth to sand and gravel: 7 to 14 inches

A horizon
Hue: 10YR or 2.5Y
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 10 to 20 percent
Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles; 15 to 30 percent pebbles
Reaction: pH 6.6 to 7.8

Bk horizon
Hue: 10YR or 2.5Y
Value: 4 to 8 dry; 2 to 6 moist
Chroma: 2 to 4
Texture: Loam or sandy loam
Clay content: 10 to 20 percent
Content of rock fragments: 35 to 50 percent—0 to 5 percent cobbles; 35 to 45 percent pebbles
Reaction: pH 6.6 to 9.0

2C horizon
Hue: 10YR or 2.5Y
Value: 4 to 7 dry; 3 to 6 moist
Chroma: 2 to 4
Texture: Sand, loamy sand, or loamy coarse sand
Clay content: 0 to 5 percent
Content of rock fragments: 35 to 80 percent—0 to 5 percent cobbles; 35 to 75 percent pebbles
Reaction: pH 7.4 to 9.0

W—Water

Composition

Major Components
Water: 100 percent

Major Component Description

Definition: Areas of open water

Wayden Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Slow

Landform: Hills
Parent material: Residuum from semiconsolidated shale
Slope range: 2 to 45 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Clayey, montmorillonitic (calcareous), frigid, shallow Typic Ustorthents

Typical Pedon

Wayden silty clay loam, in an area of Winifred-Wayden-Cabba complex, 2 to 15 percent slopes, in an area of rangeland, 2,500 feet north and 100 feet east of the southwest corner of sec. 22, T. 25 N., R. 7 W.

A—0 to 3 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, moderately sticky, moderately plastic; common fine and medium roots; few very fine vesicular pores; slightly effervescent; slightly alkaline; clear smooth boundary.

Bw—3 to 8 inches; light gray (2.5Y 7/2) silty clay, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable, moderately sticky, moderately plastic; common fine roots; few very fine tubular pores; strongly effervescent; slightly alkaline; gradual wavy boundary.

Bk—8 to 12 inches; light gray (2.5Y 7/2) silty clay, grayish brown (2.5Y 5/2) moist; moderate medium prismatic structure; slightly hard, friable, moderately sticky, moderately plastic; few fine roots; few very fine vesicular and tubular pores; few fine threads of segregated lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cr1—12 to 18 inches; light gray (5Y 7/1) weathered shale, gray (5Y 5/1) moist; gradual wavy boundary.

Cr2—18 to 60 inches; white (5Y 8/1) semiconsolidated silty shale, gray (5Y 6/1) moist; violently effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Depth to the Cr horizon: 10 to 20 inches

A horizon
Hue: 2.5Y or 5Y
Value: 5 to 7 dry; 3 to 5 moist
Chroma: 2 or 3
Clay content: 35 to 40 percent
Reaction: pH 7.4 to 8.4

Bw and Bk horizons
Hue: 2.5Y or 5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 1 to 4
Texture: Clay loam, silty clay loam, or silty clay
Clay content: 35 to 50 percent
Reaction: pH 7.4 to 8.4

187F—Wayden-Cabba-Winifred complex, 15 to 45 percent slopes

Setting

Landform:
- Wayden—Hills
- Cabba—Hills
- Winifred—Hills

Position on landform:
- Wayden—Backslopes and shoulders
- Cabba—Backslopes and shoulders
- Winifred—Backslopes and footslopes

Slope:
- Wayden—15 to 45 percent
- Cabba—15 to 45 percent
- Winifred—15 to 45 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Wayden and similar soils: 35 percent
Cabba and similar soils: 30 percent
Winifred and similar soils: 20 percent

Minor Components
Amor and similar soils: 0 to 6 percent
Linwell and similar soils: 0 to 6 percent
Shambo and similar soils: 0 to 3 percent

Major Component Description

Wayden
Surface layer texture: Silty clay loam
Depth class: Shallow (10 to 20 inches)

Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.9 inches

Cabba
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

Winifred
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 4.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Whitore Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Mountain slopes
Parent material: Colluvium and alpine till
Slope range: 8 to 60 percent
Mean annual precipitation: 18 to 24 inches
Annual air temperature: 37 to 40 degrees F
Frost-free period: 50 to 90 days

Taxonomic Class: Loamy-skeletal, carbonatic Typic Cryochrepts

Typical Pedon

Whitore stony loam, in an area of Whitore-Starley, stony loams, 15 to 45 percent slopes, in an area of forest land, 2,600 feet north and 500 feet east of the southwest corner of sec. 31, T. 23 N., R. 8 W.

A—0 to 5 inches; brown (10YR 5/3) stony loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots; many medium vesicular pores; 20 percent stones and cobbles and 5 percent pebbles; slightly effervescent; neutral; clear smooth boundary.

Bw—5 to 9 inches; brown (10YR 5/3) very cobbly loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; common fine and medium roots; common medium vesicular pores; 25 percent stones and cobbles and 15 percent pebbles; slightly effervescent; slightly alkaline; gradual wavy boundary.

Bk1—9 to 24 inches; pale brown (10YR 6/3) very cobbly loam, brown (10YR 5/2) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; common fine roots; few medium vesicular pores; 35 percent stones and cobbles and 25 percent pebbles; many medium masses of lime and lime concretions coating fragments; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—24 to 60 inches; light gray (10YR 7/2) extremely cobbly loam, light brownish gray (10YR 6/2) moist; massive structure; loose, nonsticky, nonplastic; common lime concretions coating fragments; 40 percent stones and cobbles and 35 percent pebbles; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 38 to 42 degrees F
Depth to the calcic horizon: 5 to 15 inches

A horizon
Value: 4 to 6 dry; 3 or 4 moist
Chroma: 1 to 3
Clay content: 20 to 27 percent
Content of rock fragments: 15 to 35 percent—10 to 25 percent stones and cobbles; 5 to 10 percent pebbles
Reaction: pH 6.6 to 7.8

Bw horizon
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Clay loam or loam
Clay content: 20 to 35 percent
Content of rock fragments: 15 to 60 percent—10 to 25 percent stones and cobbles; 5 to 35 percent pebbles or channers

Effervescence: Slightly to violently in the lower half
Reaction: pH 7.4 to 9.0

Bk horizons
Hue: 10YR or 2.5Y
Value: 6 to 8 dry; 4 to 7 moist
Chroma: 2 to 4
Texture: Clay loam or loam
Clay content: 20 to 35 percent
Content of rock fragments: 35 to 85 percent—0 to 40 percent stones and cobbles; 25 to 45 percent pebbles or channers
Calcium carbonate equivalent: 40 to 50 percent
Reaction: pH 7.4 to 9.0

191F—Whitore-Starley stony loams, 15 to 45 percent slopes

Setting

Landform:
• Whitore—Mountains
• Starley—Mountains
Position on landform:
• Whitore—Backslopes and shoulders
• Starley—Shoulders and summits
Slope:
• Whitore—15 to 45 percent
• Starley—15 to 45 percent
Elevation: 5,000 to 6,300 feet
Mean annual precipitation: 20 to 24 inches
Frost-free period: 55 to 75 days

Composition

Major Components
Whitore and similar soils: 45 percent
Starley and similar soils: 40 percent

Minor Components
Tibson and similar soils: 0 to 6 percent
Hanson and similar soils: 0 to 5 percent
Garlet and similar soils: 0 to 4 percent

Major Component Description

Whitore
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 4.3 inches

Starley
Surface layer texture: Stony loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 1.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

596E—Whitore-Babb-Tibson complex, 8 to 45 percent slopes

Setting

Landform:
• Whitore—Mountains
• Babb—Mountains
• Tibson—Mountains
Position on landform:
• Whitore—Backslopes and shoulders
• Babb—Backslopes and footslopes
• Tibson—Backslopes and shoulders
Slope:
• Whitore—15 to 45 percent
• Babb—8 to 45 percent
• Tibson—8 to 45 percent
Elevation: 5,000 to 6,000 feet
Mean annual precipitation: 18 to 21 inches
Frost-free period: 60 to 90 days

Composition

Major Components
Whitore and similar soils: 35 percent
Babb and similar soils: 25 percent
Tibson and similar soils: 25 percent

Minor Components
Hanson and similar soils: 0 to 7 percent
Garlet and similar soils: 0 to 3 percent
Starley and similar soils: 0 to 3 percent
Gallatin and similar soils: 0 to 2 percent

Major Component Description

Whitore
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)

Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 4.5 inches

Babb
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.7 inches

Tibson
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 5.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

693F—Whitore-Garlet-Starley stony loams, 15 to 60 percent slopes

Setting

Landform:
- Whitore—Mountains
- Garlet—Mountains
- Starley—Mountains

Position on landform:
- Whitore—Backslopes and shoulders
- Garlet—Backslopes and footslopes
- Starley—Shoulders and summits

Slope:
- Whitore—15 to 60 percent
- Garlet—15 to 60 percent
- Starley—15 to 60 percent

Elevation: 5,000 to 6,800 feet
Mean annual precipitation: 20 to 24 inches
Frost-free period: 55 to 75 days

Composition

Major Components
Whitore and similar soils: 35 percent
Garlet and similar soils: 30 percent
Starley and similar soils: 20 percent

Minor Components
Areas of rock outcrop: 0 to 8 percent
Hanson and similar soils: 0 to 4 percent
Tibson and similar soils: 0 to 3 percent

Major Component Description

Whitore
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 4.5 inches

Garlet
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 4.8 inches

Starley
Surface layer texture: Stony loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 1.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

696E—Whitore-Teton-Tibson complex, 8 to 35 percent slopes

Setting

Landform:
- Whitore—Mountains
- Teton—Mountains
- Tibson—Mountains

Position on landform:
- Whitore—Backslopes and shoulders
- Teton—Shoulders
- Tibson—Backslopes and footslopes

Slope:
- Whitore—15 to 35 percent
- Teton—8 to 35 percent
- Tibson—8 to 35 percent

Elevation: 5,000 to 6,000 feet
Mean annual precipitation: 18 to 21 inches
Frost-free period: 60 to 90 days

Composition

Major Components
Whitore and similar soils: 45 percent
Teton and similar soils: 20 percent
Tibson and similar soils: 20 percent

Minor Components
Garlet and similar soils: 0 to 6 percent
Starley and similar soils: 0 to 5 percent
Cheadle and similar soils: 0 to 4 percent

Major Component Description

Whitore
Surface layer texture: Stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 4.5 inches

Teton
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Sandstone residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.6 inches

Tibson
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Forest land
Flooding: None
Available water capacity: Mainly 5.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Windham Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Stream terraces, hills, and relict stream terraces
Parent material: Alluvium
Slope range: 0 to 60 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy-skeletal, carbonatic Typic Calciborolls

Typical Pedon

Windham gravelly loam, 0 to 4 percent slopes, in an area of rangeland, 2,000 feet north and 2,600 feet west of the southeast corner of sec. 22, T. 26 N., R. 7 W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; loose; friable, slightly sticky, slightly plastic; many very fine and fine roots; many medium irregular pores; 25 percent limestone pebbles; slightly alkaline; clear smooth boundary.

Bk1—5 to 11 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; common very fine irregular pores; 25 percent limestone pebbles with lime crusts on undersides; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk2—11 to 19 inches; light gray (10YR 7/3) extremely gravelly loam, light brownish gray (10YR 6/2) moist; weak fine subangular blocky structure;

slightly hard, firm, slightly sticky, slightly plastic; common very fine and fine roots; common fine irregular pores; 55 percent limestone pebbles and 5 percent cobbles; lime crusts on undersides of rock fragments; violently effervescent; moderately alkaline; clear wavy boundary.

Bk3—19 to 60 inches; pale brown (10YR 6/3) extremely gravelly loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few very fine roots in the upper few inches; few very fine irregular pores; 55 percent limestone pebbles and 10 percent cobbles; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 41 to 46 degrees F
Thickness of the mollic epipedon: 7 to 16 inches
Depth to the calcic horizon: 5 to 10 inches

A horizon
Hue: 7.5YR or 10YR
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 1 to 3
Clay content: 18 to 27 percent
Content of rock fragments: 15 to 60 percent—0 to 10 percent cobbles; 15 to 50 percent pebbles
Reaction: pH 7.4 to 8.4

Bk1 horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 4 to 6 dry; 3 to 6 moist
Chroma: 2 to 4
Texture: Loam or clay loam
Clay content: 18 to 35 percent
Content of rock fragments: 10 to 75 percent—0 to 20 percent cobbles; 10 to 55 percent pebbles
Calcium carbonate equivalent: 35 to 60 percent
Reaction: pH 7.9 to 8.4

Bk2 horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 to 8 dry; 4 to 7 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy loam
Clay content: 18 to 35 percent
Content of rock fragments: 35 to 75 percent—0 to 20 percent cobbles; 35 to 55 percent pebbles
Calcium carbonate equivalent: 40 to 60 percent
Reaction: pH 7.9 to 8.4

Bk3 horizon
Hue: 7.5YR, 10YR, or 2.5Y
Value: 5 to 8 dry; 4 to 7 moist
Chroma: 2 to 4
Texture: Loam, clay loam, or sandy loam
Clay content: 18 to 35 percent
Content of rock fragments: 60 to 80 percent—5 to 20 percent cobbles; 55 to 60 percent pebbles
Calcium carbonate equivalent: 40 to 60 percent
Reaction: pH 7.9 to 8.4

29B—Windham gravelly loam, 0 to 4 percent slopes

Setting

Landform: Relict stream terraces
Slope: 0 to 4 percent
Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Windham and similar soils: 90 percent

Minor Components
Judith and similar soils: 0 to 5 percent
Kiev and similar soils: 0 to 2 percent
Utica and similar soils: 0 to 2 percent
Arrod and similar soils: 0 to 1 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

29C—Windham gravelly loam, 4 to 8 percent slopes

Setting

Landform: Relict stream terraces
Slope: 4 to 8 percent
Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Windham and similar soils: 90 percent

Minor Components
Judith and similar soils: 0 to 6 percent
Kiev and similar soils: 0 to 2 percent
Utica and similar soils: 0 to 2 percent

Major Component Description

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Winginaw Series

Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Permeability: Moderately slow
Landform: Stream terraces
Parent material: Peat
Slope range: 0 to 2 percent
Mean annual precipitation: 16 to 19 inches
Annual air temperature: 40 to 43 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy, mixed, euic Terric Borofibrists

Typical Pedon

Winginaw mucky peat, in an area of Winginaw-Birchfield mucky peats, 0 to 2 percent slopes, in an area of marshland, 2,300 feet north and 800 feet east of the southwest corner of sec. 18, T. 24 N., R. 7 W.

(Colors are for moist soil unless otherwise noted.)

Oi1—0 to 8 inches; very dark brown (10YR 2/2) and very dark brown (10YR 2/2) rubbed and pressed fibric material; 80 percent fiber—70 percent rubbed; massive; nonsticky, nonplastic; 50 percent lycopodium mosses and 45 percent herbaceous species; moderately alkaline; gradual smooth boundary.

Oi2—8 to 20 inches; dark reddish brown (5YR 3/2) rubbed, dark reddish brown (5YR 2/2) pressed; 90 percent fiber—75 percent rubbed; massive; nonsticky, nonplastic; 90 percent herbaceous species and 5 percent lycopodium mosses; slightly alkaline; gradual smooth boundary.

Oe—20 to 27 inches; very dark gray (10YR 3/1) rubbed and pressed; 45 percent fiber—20 percent rubbed; massive; slightly sticky, slightly plastic; 30 percent mineral soil; slightly alkaline; clear smooth boundary.

2Ak—27 to 33 inches; black (5Y 2/1) clay loam; massive; hard, friable, moderately sticky, moderately plastic; few fine roots; 10 percent fiber—less than 5 percent rubbed; few medium soft masses of lime; matrix is slightly effervescent; slightly alkaline; gradual wavy boundary.

2Bkg1—33 to 40 inches; mixed gray (5Y 5/1) and dark gray (5Y 4/1) gravelly clay loam; common prominent olive (5Y 5/4) and olive yellow (5Y 6/6) mottles; massive; very hard, firm, moderately sticky, moderately plastic; few fine roots; 15 percent pebbles; violently effervescent; slightly alkaline; gradual wavy boundary.

2Bkg2—40 to 60 inches; olive gray (5Y 5/2) very gravelly loam; common distinct olive (5Y 5/4) and olive yellow (5Y 6/6) mottles; massive; very hard, firm, moderately sticky, moderately plastic; 40 percent pebbles; violently effervescent; slightly alkaline.

Range in Characteristics

Soil temperature: 41 to 45 degrees F
Depth to the mineral horizon: 16 to 51 inches but is commonly 20 to 40 inches
Depth to the seasonal high water table: Surface to 12 inches

Oi1 horizon
Hue: 10YR or 7.5YR
Value: 2 or 3 moist
Chroma: 1 or 2
Fiber content: 70 to 90 percent unrubbed; 65 to 85 percent rubbed
Mineral content: 0 to 15 percent
Reaction: pH 6.6 to 8.4

Oi2 horizon
Hue: 10YR, 7.5YR, or 5YR
Value: 2 or 3 moist
Chroma: 1 or 2

Fiber content: 75 to 95 percent unrubbed; 65 to 85 percent rubbed
Mineral content: 0 to 15 percent
Reaction: pH 6.6 to 8.4

Oe horizon
Hue: 10YR or 7.5YR
Value: 2 or 3 moist
Chroma: 1 or 2
Fiber content: 40 to 60 percent unrubbed; 20 to 40 percent rubbed
Mineral content: 15 to 40 percent
Reaction: pH 6.6 to 8.4

2Ak horizon
Hue: 5Y or 2.5Y
Value: 2 or 3 moist
Chroma: 1 or 2
Fiber content: 5 to 20 percent unrubbed; 0 to 10 percent rubbed
Texture: Loam or clay loam
Clay content: 20 to 30 percent
Content of rock fragments: 0 to 5 percent pebbles
Reaction: pH 7.4 to 8.4

2Bkg1 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 moist
Chroma: 1 or 2
Texture: Loam or clay loam
Clay content: 20 to 30 percent
Content of rock fragments: 15 to 30 percent—0 to 5 percent cobbles; 15 to 25 percent pebbles
Calcium carbonate equivalent: 20 to 35 percent
Reaction: pH 7.4 to 8.4

2Bkg2 horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6 moist
Chroma: 1 or 2
Texture: Loam or clay loam
Clay content: 17 to 30 percent
Content of rock fragments: 25 to 60 percent—0 to 10 percent cobbles; 25 to 50 percent pebbles
Calcium carbonate equivalent: 15 to 30 percent
Reaction: pH 7.4 to 8.4

102A—Winginaw-Birchfield mucky peats, 0 to 2 percent slopes

Setting

Landform:
- Winginaw—Stream terraces
- Birchfield—Stream terraces

Slope:
- Winginaw—0 to 2 percent
- Birchfield—0 to 2 percent

Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 16 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Winginaw and similar soils: 45 percent
Birchfield and similar soils: 40 percent

Minor Components
Dougcliff and similar soils: 0 to 8 percent
Tetonview and similar soils: 0 to 7 percent

Major Component Description

Winginaw
Surface layer texture: Mucky peat
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Peat
Native plant cover type: Rangeland
Flooding: None
Water table: Apparent
Ponding: Long
Available water capacity: Mainly 12.1 inches

Birchfield
Surface layer texture: Mucky peat
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Water table: Apparent
Available water capacity: Mainly 8.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

202A—Winginaw-Dougcliff mucky peats, 0 to 2 percent slopes

Setting

Landform:
- Winginaw—Stream terraces
- Dougcliff—Stream terraces

Slope:
- Winginaw—0 to 2 percent
- Dougcliff—0 to 1 percent

Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 17 to 19 inches
Frost-free period: 90 to 100 days

Composition

Major Components
Winginaw and similar soils: 50 percent
Dougcliff and similar soils: 35 percent

Minor Components
Birchfield and similar soils: 0 to 10 percent
Tetonview and similar soils: 0 to 5 percent

Major Component Description

Winginaw
Surface layer texture: Mucky peat
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Peat
Native plant cover type: Rangeland
Flooding: None
Water table: Apparent
Ponding: Long
Available water capacity: Mainly 12.1 inches

Dougcliff
Surface layer texture: Mucky peat
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Peat
Native plant cover type: Rangeland
Flooding: None
Water table: Apparent
Available water capacity: Mainly 21.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Winifred Series

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Hills
Parent material: Residuum from semiconsolidated shale
Slope range: 0 to 45 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Fine, montmorillonitic Typic Haploborolls

Typical Pedon

Winifred silty clay loam, in an area of Wayden-Cabba-Winifred complex, 15 to 45 percent slopes, in an area of rangeland, 2,200 feet south and 1,900 feet west of the northeast corner of sec. 14, T. 24 N., R. 8 W.

A—0 to 5 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to strong medium granular; very hard, firm, moderately sticky, moderately plastic; many very fine and fine roots; few very fine vesicular pores; slightly effervescent; slightly alkaline; clear smooth boundary.

Bw—5 to 16 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 4/2) moist; strong medium prismatic structure parting to strong medium subangular blocky; very hard, firm, moderately sticky, very plastic; common very fine and fine roots; few very fine tubular pores; strongly effervescent; slightly alkaline; gradual wavy boundary.

Bk—16 to 26 inches; light gray (5Y 7/2) clay, light olive gray (5Y 6/2) moist; weak coarse prismatic structure in the upper part grading to moderate medium platy in the lower part; very hard, firm, moderately sticky, very plastic; few fine roots; few very fine tubular pores; 15 percent soft shale fragments; common fine threads of segregated lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Cr—26 to 60 inches; light gray (5Y 7/1) semiconsolidated shale; slightly effervescent.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Thickness of the mollic epipedon: 7 to 15 inches
Depth to the Bk horizon: 11 to 22 inches
Depth to the Cr horizon: 20 to 40 inches

A horizon
Hue: 10YR or 2.5Y
Value: 3 to 5 dry; 2 or 3 moist
Chroma: 2 or 3
Clay content: 27 to 40 percent
Reaction: pH 6.6 to 7.8

Bw horizon
Hue: 10YR or 2.5Y
Value: 4 or 5 dry; 3 or 4 moist
Chroma: 2 or 3
Texture: Clay loam, silty clay, clay, or silty clay loam
Clay content: 35 to 50 percent
Content of rock fragments: 0 to 15 percent—0 to 10 percent cobbles; 0 to 5 percent pebbles
Effervescence: None to strongly
Reaction: pH 7.4 to 8.4

Bk horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Clay, silty clay, silty clay loam, or clay loam
Clay content: 35 to 50 percent
Content of rock fragments: 0 to 15 percent—0 to 10 percent cobbles; 0 to 5 percent pebbles
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.4 to 9.0

285C—Winifred-Wayden-Cabba complex, 2 to 15 percent slopes

Setting

Landform:
- Winifred—Hills
- Wayden—Hills
- Cabba—Hills

Position on landform:
- Winifred—Footslopes
- Wayden—Shoulders
- Cabba—Shoulders

Slope:
- Winifred—2 to 15 percent
- Wayden—2 to 15 percent
- Cabba—2 to 15 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Winifred and similar soils: 35 percent
Wayden and similar soils: 30 percent
Cabba and similar soils: 20 percent

Minor Components
Castner and similar soils: 0 to 7 percent
Linwell and similar soils: 0 to 5 percent
Amor and similar soils: 0 to 3 percent

Major Component Description

Winifred
Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.9 inches

Wayden
Surface layer texture: Silty clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 1.9 inches

Cabba
Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Winspect Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow
Landform: Moraines and hills
Parent material: Alpine till
Slope range: 2 to 35 percent
Mean annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy-skeletal, mixed Typic Calciborolls

Typical Pedon

Winspect cobbly loam, in an area of Beanlake-Winspect cobbly loams, 2 to 15 percent slopes, in an area of rangeland, 2,300 feet north and 2,200 feet west of the southeast corner of sec. 24, T. 25 N., R. 8 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots; common very fine and fine irregular pores; 10 percent cobbles and 10 percent pebbles; slightly effervescent; slightly alkaline; clear smooth boundary.

Bw—4 to 8 inches; brown (10YR 5/3) cobbly loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium roots; common fine irregular pores; 15 percent cobbles and 10 percent pebbles; strongly effervescent; slightly alkaline; clear wavy boundary.

Bk1—8 to 18 inches; light brownish gray (10YR 6/2) cobbly clay loam, dark grayish brown (10YR 4/2) moist; weak medium subangular structure; hard, friable, moderately sticky, slightly plastic; common very fine and fine roots; common very fine irregular pores; 20 percent cobbles and 10 percent pebbles; many medium soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—18 to 60 inches; light gray (10YR 7/2) very cobbly clay loam, brown (10YR 5/3) moist; massive; slightly hard, friable, moderately sticky, moderately plastic; few very fine roots; 25 percent cobbles and 25 percent pebbles; common medium and soft masses of lime; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 41 to 47 degrees F
Thickness of the mollic epipedon: 7 to 14 inches

A horizon
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 1 or 2
Clay content: 20 to 25 percent
Content of rock fragments: 15 to 30 percent—0 to 5 percent stones; 5 to 15 percent cobbles; 10 to 15 percent pebbles
Reaction: pH 7.4 to 8.4

Bw horizon
Value: 4 or 5 dry; 2 or 3 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 20 to 30 percent
Content of rock fragments: 20 to 60 percent—0 to 10 percent stones; 5 to 20 percent cobbles; 10 to 30 percent pebbles
Calcium carbonate equivalent: 10 to 20 percent
Reaction: pH 7.4 to 8.4

Bk1 horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam, clay loam, or sandy clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 35 to 60 percent—0 to 5 percent stones; 5 to 25 percent cobbles; 20 to 35 percent pebbles
Calcium carbonate equivalent: 15 to 40 percent
Reaction: pH 7.9 to 8.4

Bk2 horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 or 3
Texture: Loam, clay loam, or sandy clay loam
Clay content: 20 to 35 percent
Content of rock fragments: 35 to 60 percent—10 to 25 percent cobbles; 25 to 35 percent pebbles
Calcium carbonate equivalent: 15 to 40 percent
Reaction: pH 7.9 to 8.4

327E—Winspect-Beanlake cobbly loams, 15 to 35 percent slopes

Setting

Landform:
- Winspect—Moraines
- Beanlake—Moraines

Position on landform:
- Winspect—Shoulders and summits
- Beanlake—Backslopes and footslopes

Slope:
- Winspect—15 to 35 percent
- Beanlake—15 to 35 percent

Elevation: 4,200 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Frost-free period: 90 to 110 days

Composition

Major Components
Winspect and similar soils: 45 percent
Beanlake and similar soils: 40 percent

Minor Components
Shawmut and similar soils: 0 to 5 percent
Judith and similar soils: 0 to 4 percent
Windham and similar soils: 0 to 4 percent
Utica and similar soils: 0 to 2 percent

Major Component Description

Winspect
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.0 inches

Beanlake
Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alpine till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 8.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Yamacall Series

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Landform: Alluvial fans
Parent material: Alluvium
Slope range: 2 to 15 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Fine-loamy, mixed, frigid Aridic Ustochrepts

Typical Pedon

Yamacall loam, in an area of Yamacall-Delpoint loams, 2 to 8 percent slopes, in an area of rangeland, 2,250 feet south and 1,200 feet east of the northwest corner of sec. 7, T. 23 N., R. 4 W.

A1—0 to 2 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium roots; common very fine irregular pores; slightly effervescent; moderately alkaline; clear smooth boundary.

A2—2 to 4 inches; grayish brown (10YR 5/2) loam, dark brown (10YR 3/3) moist; moderate fine and medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; common fine and medium roots; common very fine and fine discontinuous pores; slightly effervescent; moderately alkaline; clear smooth boundary.

Bw—4 to 11 inches; grayish brown (10YR 6/2) loam, grayish brown (10YR 5/2) moist; moderate fine prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky, moderately plastic; common fine and medium roots; common very fine vesicular pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—11 to 15 inches; light brownish gray (2.5Y 6/2) loam, brownish gray (2.5Y 5/2) moist; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky, moderately plastic; common fine roots; many very fine vesicular and irregular pores; 15 percent weathered sandstone fragments; common medium soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—15 to 60 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; slightly hard, firm, moderately sticky, moderately plastic; few fine roots; 15 percent weathered sandstone fragments; common medium soft masses of lime; violently effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Bk horizon: 10 to 20 inches

A horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 or 6 dry; 3 to 5 moist
Chroma: 2 to 4

Clay content: 18 to 27 percent
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4
Other features: When mixed to 7 inches, this horizon will not meet the requirements for a mollic epipedon.

Bw horizon
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or silt loam
Clay content: 18 to 27 percent with 15 to 35 percent fine sand and coarser
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

Bk horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or silt loam
Clay content: 18 to 30 percent with 15 to 35 percent fine sand and coarser
Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles; 0 to 10 percent pebbles
Electrical conductivity: 0 to 4 mmhos/cm
Calcium carbonate equivalent: 5 to 15 percent
Effervescence: Strongly or violently
Reaction: pH 7.9 to 9.0

151C—Yamacall-Delpoint loams, 2 to 8 percent slopes

Setting

Landform:
- Yamacall—Alluvial fans
- Delpoint—Sedimentary plains

Position on landform:
- Yamacall—Footslopes
- Delpoint—Backslopes and footslopes

Slope:
- Yamacall—2 to 8 percent
- Delpoint—2 to 8 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Yamacall and similar soils: 45 percent
Delpoint and similar soils: 40 percent

Minor Components
Kremlin and similar soils: 0 to 8 percent
Cabbart and similar soils: 0 to 7 percent

Major Component Description

Yamacall
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

151D—Yamacall-Delpoint, loams, 8 to 15 percent slopes

Setting

Landform:
- Yamacall—Alluvial fans
- Delpoint—Hills

Position on landform:
- Yamacall—Backslopes and footslopes
- Delpoint—Backslopes and shoulders

Slope:
- Yamacall—8 to 15 percent
- Delpoint—8 to 15 percent

Elevation: 3,200 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Yamacall and similar soils: 45 percent
Delpoint and similar soils: 40 percent

Minor Components
Cabbart and similar soils: 0 to 9 percent
Kremlin and similar soils: 0 to 6 percent

Major Component Description

Yamacall
Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Yawdim Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Slow
Landform: Hills
Parent material: Residuum from semiconsolidated shale or interbedded shale and siltstone
Slope range: 4 to 60 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Clayey, montmorillonitic (calcareous), frigid, shallow Aridic Ustorthents

Typical Pedon

Yawdim silty clay loam, in an area of Abor-Yawdim silty clay loams, 15 to 35 percent slopes, in an area of rangeland, 1,300 feet south and 200 feet west of the northeast corner of sec. 29, T. 24 N., R. 1 W.

A—0 to 5 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate fine and medium granular structure; hard, friable, moderately sticky, moderately plastic; common fine roots; common very fine pores; slightly effervescent; neutral; clear smooth boundary.
C1—5 to 8 inches; pale brown (10YR 6/3) silty clay loam, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, friable, moderately sticky, very plastic; common fine roots; few very fine pores; 10 percent weathered shale fragments in lower part; strongly effervescent; moderately alkaline; clear wavy boundary.
C2—8 to 16 inches; pale brown (10YR 6/3) silty clay loam, olive brown (2.5Y 4/4) moist; few faint light olive brown (2.5Y 5/4) mottles; weak fine and medium subangular blocky structure; hard, friable, moderately sticky, moderately plastic; common very fine and fine roots; 40 percent soft shale fragments; slightly effervescent; moderately alkaline; gradual wavy boundary.
Cr—16 to 60 inches; light yellowish brown (2.5Y 6/4) semiconsolidated shale, grayish brown (2.5Y 5/2) moist; common fine light olive brown (2.5Y 5/6) stains on plates; few fine roots in upper few inches.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to the Cr horizon: 10 to 20 inches

A horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 3 or 4 moist
Chroma: 1 to 3
Clay content: 27 to 40 percent
Reaction: pH 6.6 to 7.8

C horizons
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 8 dry; 4 to 6 moist
Chroma: 1 to 4
Texture: Silty clay loam, clay loam, or clay

Clay content: 35 to 50 percent
Reaction: pH 7.4 to 8.4

189E—Yawdim-Delpoint-Rock outcrop complex, 8 to 35 percent slopes

Setting

Landform:
- Yawdim—Hills
- Delpoint—Hills

Position on landform:
- Yawdim—Backslopes and shoulders
- Delpoint—Backslopes and footslopes

Slope:
- Yawdim—8 to 35 percent
- Delpoint—8 to 35 percent
- Rock outcrop—8 to 35 percent

Elevation: 3,800 to 4,200 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Yawdim and similar soils: 40 percent
Delpoint and similar soils: 30 percent
Rock outcrop: 15 percent

Minor Components
Cabbart and similar soils: 0 to 9 percent
Abor and similar soils: 0 to 6 percent

Major Component Description

Yawdim
Surface layer texture: Silty clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.7 inches

Delpoint
Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.8 inches

Rock outcrop
Definition: Mainly semiconsolidated shale bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

Yetull Series

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Permeability: Rapid
Landform: Hills and sedimentary plains
Parent material: Alluvium or eolian material
Slope range: 0 to 25 percent
Mean annual precipitation: 11 to 14 inches
Annual air temperature: 41 to 45 degrees F
Frost-free period: 105 to 125 days

Taxonomic Class: Mixed, frigid Typic Ustipsamments

Typical Pedon

Yetull loamy fine sand, in an area of Twilight-Chinook-Yetull complex, 2 to 8 percent slopes, in an area of nonirrigated cropland, 1,600 feet north and 1,100 feet west of the southeast corner of sec. 14, T. 28 N., R. 5 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky, nonplastic; many fine roots; slightly effervescent; neutral; clear smooth boundary.

C1—7 to 19 inches; brown (10YR 5/3) loamy fine sand, dark grayish brown (10YR 4/2) moist; single grain; soft, very friable, nonsticky, nonplastic; many very fine and fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

C2—19 to 30 inches; pale brown (10YR 6/3) loamy fine sand that has thin strata of fine sandy loam, brown (10YR 5/3) moist; single grain; soft, very friable, slightly sticky, nonplastic; common very fine and fine roots; strongly effervescent; moderately alkaline; clear wavy boundary.

C3—30 to 60 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grain; soft, very friable, nonsticky, nonplastic; few fine roots; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F

Ap horizon
- Hue: 10YR or 2.5Y
- Value: 5 or 6 dry; 3 or 4 moist
- Chroma: 2 to 4
- Clay content: 0 to 10 percent
- Calcium carbonate equivalent: 0 to 10 percent
- Effervescence: None to strongly
- Reaction: pH 6.6 to 8.4

C1 horizon
- Hue: 10YR or 2.5Y
- Value: 4 to 6 dry; 4 or 5 moist
- Chroma: 2 to 4
- Texture: Sand, fine sand, loamy sand, loamy coarse sand, loamy fine sand, or coarse sand
- Clay content: 0 to 10 percent
- Content of rock fragments: 0 to 15 percent pebbles
- Calcium carbonate equivalent: 1 to 10 percent
- Effervescence: Slightly or strongly
- Reaction: pH 7.4 to 8.4

C2 horizon
- Hue: 10YR or 2.5Y
- Value: 4 to 6 dry; 4 or 5 moist
- Chroma: 2 to 4
- Texture: Sand, fine sand, loamy sand, loamy coarse sand, loamy fine sand, or coarse sand
- Clay content: 0 to 10 percent
- Content of rock fragments: 0 to 15 percent pebbles
- Calcium carbonate equivalent: 3 to 10 percent
- Effervescence: Slightly, strongly, or violently
- Reaction: pH 7.4 to 8.4

C3 horizon
- Hue: 10YR or 2.5Y
- Value: 4 to 6 dry; 4 or 5 moist
- Chroma: 2 to 4
- Texture: Sand, fine sand, loamy sand, loamy coarse sand, loamy fine sand, or coarse sand
- Clay content: 0 to 10 percent
- Effervescence: Strongly or violently
- Calcium carbonate equivalent: 3 to 10 percent
- Reaction: pH 7.4 to 8.4

42C—Yetull loamy fine sand, 0 to 15 percent slopes

Setting

Landform: Hills
Slope: 0 to 15 percent
Elevation: 3,200 to 4,000 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 105 to 125 days

Composition

Major Components
Yetull and similar soils: 90 percent

Minor Components
Chinook and similar soils: 0 to 5 percent
Twilight and similar soils: 0 to 5 percent

Major Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Alluvium or eolian material
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Management

For management information about this map unit, see appropriate sections in Part II of this publication.

References

Alexander, R.R. 1966. Site indexes for lodgepole pine with corrections for stand density; instructions for field use. U.S. Department of Agriculture, Forest Service. Rocky Mountain Forest and Range Experiment Station Research Paper, RP-24.

Alexander, R.R. 1967. Site indexes for Engelmann spruce. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station Research Paper, RP-32.

American Association of State Highway and Transportation Officials (AASHTO). 1986. Standard specifications for highway materials and methods of sampling and testing. 14th edition, 2 volumes.

American Society for Testing and Materials (ASTM). 1988. Standard test method for classification of soils for engineering purposes. ASTM Standard D 2487-00.

Baker, F.S. 1925. Aspen in the Central Rocky Mountain Region. United States Department of Agriculture Bulletin 1291.

Brickell, J.E. 1968. A method for constructing site index curves from measurements of tree age and height—Its application to inland Douglas-fir. U.S. Department of Agriculture, Forest Service, Intermountain Research Station Research Paper INT-RP-47.

Colton, R.B., R.W. Lemke, W. Richard, and R.M. Lindvall. 1961. Glacial map of Montana east of the Rocky Mountains. U.S. Geological Survey geologic map (1:500,000), I-0327.

Dahms, W.G. 1964. Gross and net yield tables for lodgepole pine. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, OR, Research Paper PNW-8.

Gieseker, L.F. 1934. Soils of Pondera County, Soil Reconnaissance of Montana. Preliminary Report. Montana State College, Agricultural Experiment Station. Bulletin No. 291.

Gieseker, L.F. 1937. Soils of Teton County, Soil Reconnaissance of Montana. Preliminary Report. Montana State College, Agricultural Experiment Station. Bulletin No. 332.

Meyer, W.H. 1938. Yield of even-aged stands of ponderosa pine. U.S. Department of Agriculture, Technical Bulletin 630. Washington, DC.

Myers, C.A. 1967. Yield tables for managed stands of lodgepole pine in Colorado and Wyoming. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station Research Paper RM-RP-26.

Noble, R.A., R.N. Bergantino, T.W. Patton, B.C. Sholes, F. Daniel, and J. Scofield. 1982. Occurrence and characteristics of ground water in Montana. Montana Bureau of Mines and Geology Open-File Report 99.

Perry, E.S. 1960. Oil and gas in Montana. Montana Bureau of Mines and Geology Bulletin 15.

Pfister, R.D., B.L. Kovalchik, S.F. Arno, and R.C. Presby. 1977. Forest habitat types of Montana. U.S. Department of Agriculture, Forest Service, Intermountain Research Station General Technical Report INT-GTR-34.

Sauerwein, W.J. 1979. Site index for black cottonwood. Compiled from British Columbia Forest Service data. U.S. Department of Agriculture, Soil Conservation Service, Western Region.

Soil Survey Division Staff. 1962. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. (http://soils.usda.gov/technical/manual/)

Soil Survey Staff. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436. (http://soils.usda.gov/technical/classification/taxonomy/)

Soil Survey Staff. 1987. Keys to soil taxonomy. 3rd edition. U.S. Department of Agriculture, Natural Resources Conservation Service. (http://soils.usda.gov/technical/classification/tax_keys/)

United States Department of Agriculture, Natural Resources Conservation Service. Montana Field Office Technical Guide, Section II. (http://www.nrcs.usda.gov/technical/efotg/)

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

United States Department of Agriculture, Soil Conservation Service. 1976. National range handbook. (http://www.glti.nrcs.usda.gov/technical/publications/nrph.html)

United States Department of Agriculture, Soil Conservation Service, and United States Department of the Interior, Bureau of Indian Affairs. 1980. Soil Survey of Glacier County Area and part of Pondera County, Montana.

Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. (See Sodic (alkali) soil.)

Alluvial fan. A body of alluvium, with overflow of water and debris flow deposits, whose surface forms a segment of a cone that radiates downslope from the point where the stream emerges from a narrow valley onto a less sloping surface. Source uplands range in relief and areal extent from mountains to gullied terrains on hillslopes.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redox feature.

Animal-unit-month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redox features.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillite. Weakly metamorphosed mudstone or shale.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3.75
Low	3.75 to 5.0
Moderate	5.0 to 7.5
High	more than 7.5

Avalanche chute. The track or path formed by an avalanche.

Backslope. The geomorphic component that forms the steepest inclined surface and principal element of many hillslopes. Backslopes in profile are commonly steep and linear and descend to a footslope. In terms of gradational process, backslopes are erosional forms produced mainly by mass wasting and running water.

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope. A geomorphic component of hills consisting of the concave to linear (perpendicular

to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Bedding planes. Fine strata, less than 5-millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-floored plain. An extensive nearly level to gently rolling or moderately sloping area that is underlain by hard bedrock and has a slope of 0 to 8 percent.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of cobbles or gravel. In some blowouts, the water table is exposed.

Board foot. A unit of measure of the wood in lumber, logs, or trees. The amount of wood in a board 1 foot wide, 1 foot long, and 1 inch thick before finishing.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Bouldery. Refers to a soil with .01 to 0.1 percent of the surface covered with boulders.

Bouldery soil material. Soil that is 15 to 35 percent, by volume, rock fragments that are dominated by fragments larger than 24 inches (60 centimeters) in diameter.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management. Use of mechanical, chemical, or biological methods to reduce or eliminate competition from woody vegetation and thus to allow understory grasses and forbs to recover or to make conditions favorable for reseeding. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds directly beneath the solum, or it is exposed at the surface by erosion.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channeled. Refers to a drainage area in which natural meandering or repeated branching and convergence of a streambed have created deeply incised cuts, either active or abandoned, in alluvial material.

Channery soil material. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Cirque. A semicircular, concave, bowl-like area that has steep faces primarily resulting from erosive activity of a mountain glacier.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clayey soil. Silty clay, sandy clay, or clay.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Clearcut. A method of forest harvesting that removes the entire stand of trees in one cutting. Reproduction is achieved artificially or by natural seeding from the adjacent stands.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Closed depression. A low area completely surrounded by higher ground and having no natural outlet.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

Codominant trees. Trees whose crowns form the general level of the forest canopy and that receive full light from above but comparatively little from the sides.

COLE (coefficient of linear extensibility). (See Linear extensibility.)

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Commercial forest. Forestland capable of producing 20 cubic feet or more per acre per year at the culmination of mean annual increment.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conglomerate. A coarse-grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer-textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. Any tillage and planting system in which a cover of crop residue is maintained on at least 30 percent of the soil surface after planting in order to reduce the hazard of water erosion. In areas where soil blowing is the primary concern, a system that maintains a cover of at least 1,000 pounds of flat residue of small grain or the equivalent during the critical erosion period.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to

compression. Terms describing consistence are defined in the “Soil Survey Manual” (Soil Survey Division Staff, 1962).

Consolidated sandstone. Sandstone that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry, are not easily crushed, and cannot be textured by the usual field method.

Consolidated shale. Shale that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry and are not easily crushed.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deep soil. A soil that is 40 to 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Dominant trees. Trees whose crowns form the general level of the forest canopy and that receive full light from above and from the sides.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown, and yields are low.

Well drained.—These soils have an intermediate water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless a drainage system is installed. Moderately well-drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless a drainage system is installed. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet, at or near the surface, during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except rice) unless a drainage system is installed.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainageway. An area of ground at a lower elevation than the surrounding ground and in which water collects and is drained to a closed depression or lake or to a drainageway at a lower elevation. A drainageway may or may not have distinctly incised channels at its upper reaches or throughout its course.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Dune. A mound, ridge, or hill of loose, windblown granular material (generally sand), either bare or covered with vegetation.

Ecological site. An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Esker. A long, narrow, sinuous, steep-sided ridge composed of irregularly stratified sand and gravel that were deposited by a subsurface stream flowing between ice walls or through ice tunnels of a retreating glacier and that were left behind when the ice melted. Eskers range from less than a mile to more than 100 miles in length and from 10 to 100 feet in height.

Even aged. Refers to a stand of trees in which only small differences in age occur between individual trees. A range of 20 years is allowed.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess salt (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well-preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. Area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (300 meters) and fringes a mountain range or high-plateau escarpment.

Footslope. The geomorphic component that forms the inner, gently inclined surface at the base of a hillslope. The surface profile is dominantly concave. In terms of gradational processes, a footslope is a transitional zone between an upslope site of erosion (backslope) and a downslope site of deposition (toeslope).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Giant ripple mark. The undulating surface sculpture produced in noncoherent granular materials by currents of water and by the agitation of water in

wave action during the draining of large glacial lakes, such as Glacial Lake Missoula.

Glacial drift. Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciated uplands. Land areas that were previously covered by continental or alpine glaciers and that are at a higher elevation than the flood plain.

Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Soil that is 15 to 35 percent, by volume, rounded or angular rock fragments up to 3 inches (7.6 centimeters) in diameter. Very gravelly soil is 35 to 60 percent gravel, and extremely gravelly soil is more than 60 percent gravel by volume.

Grazeable forestland. Land capable of sustaining livestock grazing by producing forage of sufficient quantity during one or more stages of secondary forest succession.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Gypsum. A mineral consisting of hydrous calcium sulfate.

Habitat type. An aggregation of all land areas capable of producing similar climax plant communities.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head out. To form a flower head.

Heavy metal. Inorganic substances that are solid at ordinary temperatures and are not soluble in water. They form oxides and hydroxides that are basic. Examples are copper, iron, cadmium, zinc, manganese, lead, and arsenic.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well-defined outline; hillsides generally have slopes of more than 8 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual" (Soil Survey Division Staff, 1962). The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A or E horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Sedimentary beds of consolidated sandstone and semiconsolidated and consolidated shale. Generally, roots can penetrate this horizon only along fracture planes.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame. A moundlike hill of glacial drift, composed chiefly of stratified sand and gravel.

Kame terrace. A terracelike ridge consisting of stratified sand and gravel that were deposited by a meltwater stream flowing between a melting glacier and a higher valley wall or lateral moraine and that remained after the disappearance of the ice. It is commonly pitted with kettles and has an irregular ice-contact slope.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain. A surface marking the floor of an extinct lake, filled in by well-sorted, stratified sediments.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Lateral moraine. A ridgelike moraine carried on and deposited at the side margin of a valley glacier. It is composed chiefly of rock fragments derived from the valley walls by glacial abrasion and plucking or by mass wasting.

Leaching. The removal of soluble material from soil or other material by percolating water.

Linear extensibility. Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $1/_{3}$- or $1/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loamy soil. Coarse sandy loam, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, silt, clay loam, sandy clay loam, or silty clay loam.

Loess. Fine-grained material, dominantly of silt-sized particles, deposited by wind.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redox concentration.

Mean annual increment (MAI). The average annual increase in volume of a tree during its entire life.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Merchantable trees. Trees that are of sufficient size to be economically processed into wood products.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Microhigh. An area that is 2 to 12 inches higher than the adjacent microlow.

Microlow. An area that is 2 to 12 inches lower than the adjacent microhigh.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Miscellaneous water. A sewage lagoon, an industrial waste pit, a fish hatchery, or a similar water area.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately deep soil. A soil that is 20 to 40 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine. An accumulation of glacial drift in a topographic landform of its own, resulting chiefly from the direct action of glacial ice. Some types are lateral, recessional, and terminal.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Areas of color that differ from the matrix color. These colors are commonly attributes retained from the geologic parent material. (See Redox features for indications of poor aeration and impeded drainage.)

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Muck. Dark, finely divided, well-decomposed organic soil material. (See Sapric soil material.)

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Naturalized pasture. Forestland that is used primarily for the production of forage for grazing by livestock rather than for the production of wood products. Overstory trees are removed or managed to promote the native and introduced understory vegetation occurring on the site. This vegetation is managed for its forage value through the use of grazing management principles.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Observed rooting depth. Depth to which roots have been observed to penetrate.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Outwash plain. An extensive area of glaciofluvial material that was deposited by meltwater streams.

Overstory. The trees in a forest that form the upper crown cover.

Oxbow. The horseshoe-shaped channel of a former meander, remaining after the stream formed a cutoff across a narrow meander neck.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots.

For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water or air to move downward through the profile.

Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit. The range of moisture content within which the soil remains plastic.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse-grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential natural community (PNC). The biotic community that would become established on an ecological site if all successional sequences were completed without interferences by man under the present environmental conditions. Natural disturbances are inherent in its development. The PNC may include acclimatized or naturalized nonnative species.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. The application of fire to land under such conditions of weather, soil moisture, and time of day as presumably will result in the intensity of heat and spread required to accomplish specific forest management, wildlife, grazing, or fire hazard reduction purposes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Quartzite, metamorphic. Rock consisting mainly of quartz that formed through recrystallization of quartz-rich sandstone or chert.

Quartzite, sedimentary. Very hard but unmetamorphosed sandstone consisting chiefly of quartz grains.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. (See Similarity index.)

Range site. (See Ecological site.)

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Recessional moraine. A moraine formed during a temporary but significant halt in the retreat of a glacier.

Red beds. Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Redox concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redox depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redox features. Redox concentrations, redox depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redox feature.

Regeneration. The new growth of a natural plant community, developing from seed.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relict stream terrace. One of a series of platforms in or adjacent to a stream valley that formed prior to the current stream system.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Riser. The relatively short, steeply sloping area below a terrace tread that grades to a lower terrace tread or base level.

Riverwash. Unstable areas of sandy, silty, clayey, or gravelly sediments. These areas are flooded, washed, and reworked by rivers so frequently that they support little or no vegetation.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, boulders, stones, cobbles, and gravel.

Rock outcrop. Exposures of bare bedrock other than lava flows and rock-lined pits.

Root zone. The part of the soil that can be penetrated by plant roots.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Rubble land. Areas that have more than 90 percent of the surface covered by stones or boulders. Voids contain no soil material and virtually no vegetation other than lichens. The areas commonly are at the base of mountain slopes, but some are on mountain slopes as deposits of cobbles, stones, and boulders left by Pleistocene glaciation or by periglacial phenomena.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the

soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salinity. The electrical conductivity of a saline soil. It is expressed, in millimhos per centimeter, as follows:

Nonsaline	0 to 4
Slightly saline	4 to 8
Moderately saline	8 to 16
Strongly saline	more than 16

Salty water (in tables). Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sandy soil. Sand or loamy sand.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Sawlogs. Logs of suitable size and quality for the production of lumber.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Scribner's log rule. A method of estimating the number of board feet that can be cut from a log of a given diameter and length.

Sedimentary plain. An extensive nearly level to gently rolling or moderately sloping area that is underlain by sedimentary bedrock and that has a slope of 0 to 8 percent.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Sedimentary uplands. Land areas of bedrock formed from water- or wind-deposited sediments. They are higher on the landscape than the flood plain.

Seepage (in tables). The movement of water through soil. Seepage adversely affects the specified use.

Semiconsolidated sedimentary beds. Soft geologic sediments that disperse when fragments are placed in water. The fragments are hard or very hard when dry. Determining the texture by the usual field method is difficult.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shallow soil. A soil that is 10 to 20 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shelterwood system. A forest management system requiring the removal of a stand in a series of cuts so that regeneration occurs under a partial canopy. After regeneration, a final cut removes the shelterwood and allows the stand to develop in the open as an even-aged stand. The system is well suited to sites where shelter is needed for regeneration, and it can aid regeneration of the more intolerant tree species in a stand.

Shoulder. The uppermost inclined surface at the top of a hillside. It is the transitional zone from the backslope to the summit of a hill or mountain. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope. A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeters) to the lower limit of very fine sand (0.05 millimeters). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Similarity index. A similarity index is the percentage of a specific vegetation state plant community that is presently on the site.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site class. A grouping of site indexes into five to seven production capability levels. Each level can be represented by a site curve.

Site curve (50-year). A set of related curves on a graph that shows the average height of dominant or dominant and codominant trees for the range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant or dominant and codominant trees that are 50 years old or are 50 years old at breast height.

Site curve (100-year). A set of related curves on a graph that shows the average height of dominant or dominant and codominant trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant or dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant or dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Skid trails. Pathways along which logs are dragged to a common site for loading onto a logging truck.

Slash. The branches, bark, treetops, reject logs, and broken or uprooted trees left on the ground after logging.

Slickens. Accumulations of fine textured material, such as material separated in placer-mine and ore-mill operations. Slickens from ore mills commonly consist of freshly ground rock that has undergone chemical treatment during the milling process.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slickspot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is loamy or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the following slope classes are recognized:

Nearly level	0 to 2 percent
Gently sloping	2 to 4 percent
Moderately sloping	4 to 8 percent
Strongly sloping	8 to 15 percent
Moderately steep	15 to 25 percent
Steep	25 to 45 percent
Very steep	more than 45 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to Ca^{++} + Mg^{++}. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Species. A single, distinct kind of plant or animal having certain distinguishing characteristics.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with tillage, or stones cover .01 to 0.1 percent of the surface. Very stony means that 0.1 to 3.0 percent of the surface is covered with stones. Extremely stony means that 3 to 15 percent of the surface is covered with stones.

Stony soil material. Soil that is 15 to 35 percent, by volume, rock fragments that are dominated by fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Strath terrace. A surface cut formed by the erosion of hard or semiconsolidated bedrock and thinly mantled with stream deposits.

Stream channel. The hollow bed where a natural stream of surface water flows or may flow; the deepest or central part of the bed, formed by the main current and covered more or less continuously by water.

Stream terrace. One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel. It originally formed near the level of the stream and is the dissected remnants of an abandoned flood plain, streambed, or valley floor that were produced during a former stage of erosion or deposition.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter or loosen a layer that is restrictive to roots.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to

produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit. A general term for the top, or highest level, of an upland feature, such as a hill or mountain. It commonly refers to a higher area that has a gentle slope and is flanked by steeper slopes.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Tailwater. The water directly downstream of a structure.

Talus. Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Terracette. Small, irregular step-like forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may or may not be induced by trampling of livestock such as sheep or cattle.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). A layer of otherwise suitable soil material that is too thin for the specified use.

Till plain. An extensive, nearly level to gently rolling or moderately sloping area that is underlain by or consists of till and that has a slope of 0 to 8 percent.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The outermost inclined surface at the base of a hill. Toeslopes are commonly gentle and linear in profile.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Trafficability. The degree to which a soil is capable of supporting vehicular traffic across a wide range in soil moisture conditions.

Tread. The relatively flat terrace surface that was cut or built by stream or wave action.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Understory. Any plants in a forest community that grow to a height of less than 5 feet.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley. An elongated depressional area primarily developed by stream action.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Very deep soil. A soil that is more than 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Very shallow soil. A soil that is less than 10 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Water-spreading. Diverting runoff from natural channels by means of a system of dams, dikes, or ditches and spreading it over relatively flat surfaces.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse-grained particles that are well distributed over wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The action of uprooting and tipping over trees by the wind.

Accessibility Statement

The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

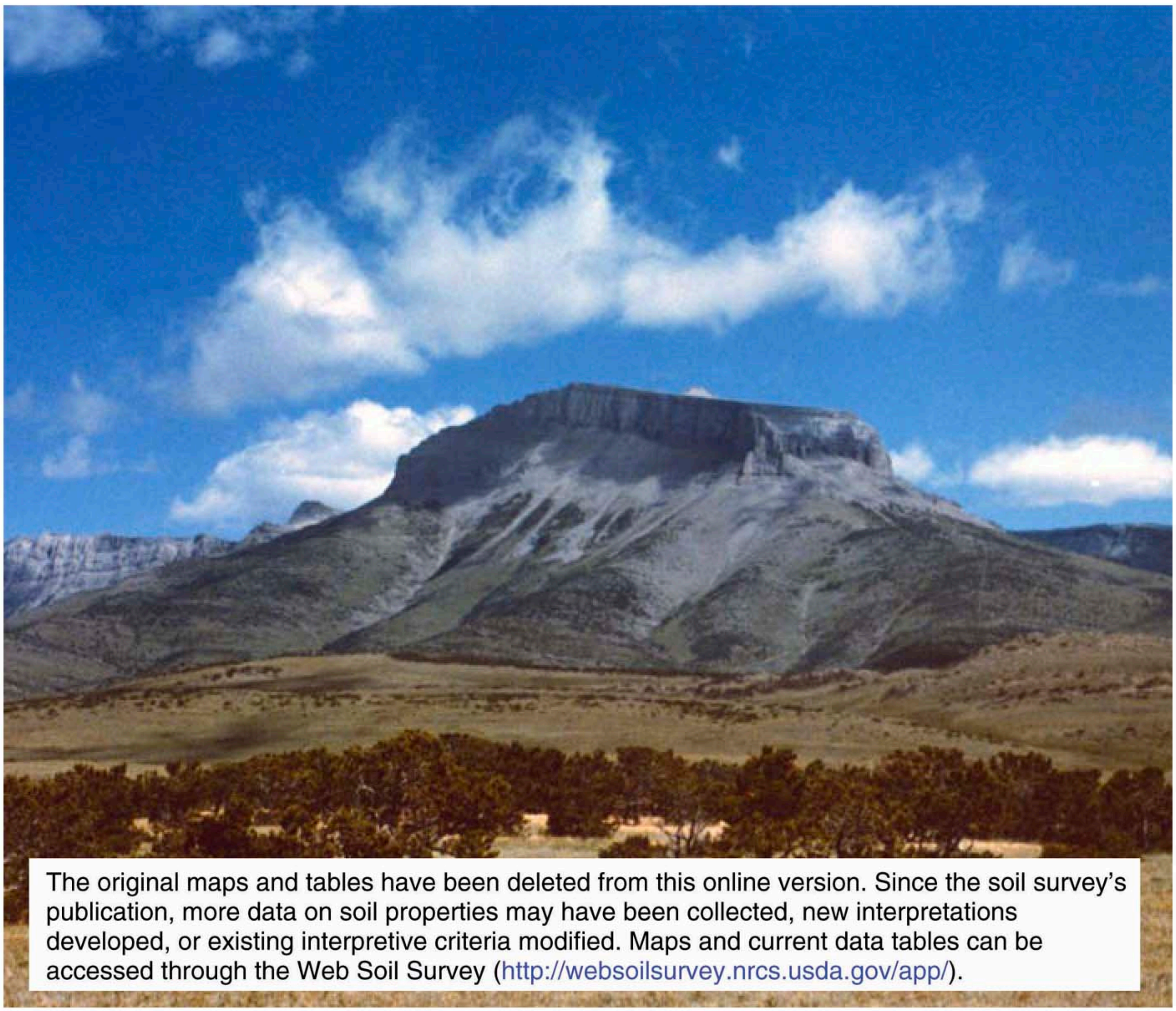
United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with the Montana Agricultural Experiment Station

MT657—Soil Survey of Choteau-Conrad Area; Parts of Teton and Pondera Counties, Montana

Part II



The original maps and tables have been deleted from this online version. Since the soil survey's publication, more data on soil properties may have been collected, new interpretations developed, or existing interpretive criteria modified. Maps and current data tables can be accessed through the Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/).

How to Use This Soil Survey

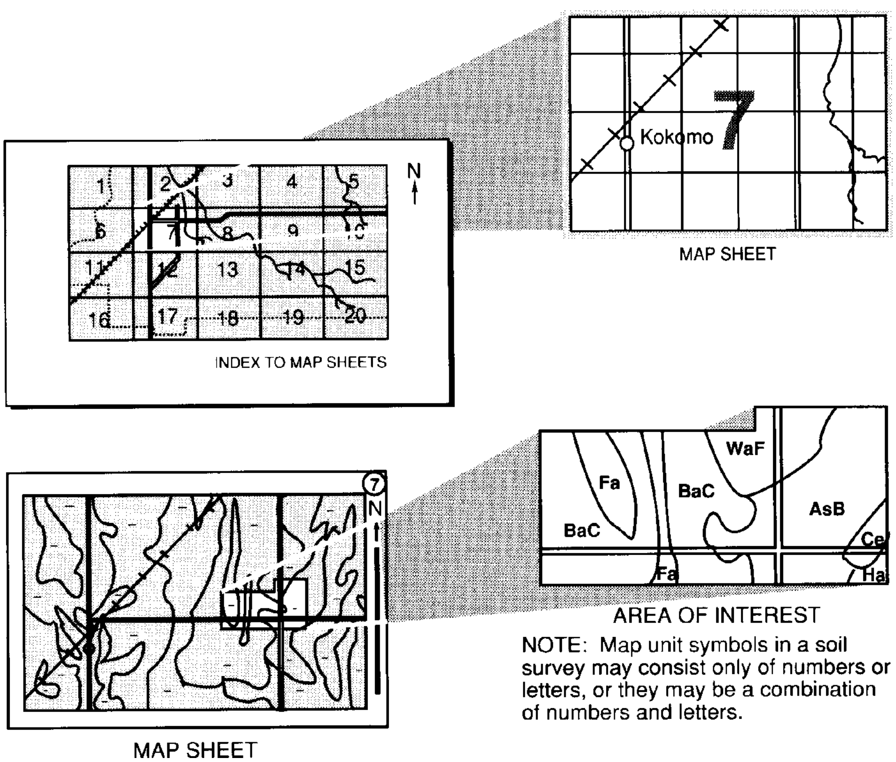
Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, you can locate the Section, Township, and Range by zooming in on the **Index to Map Sheets**, or you can go to the Web Soil Survey at (http://websoilsurvey.nrcs.usda.gov/app/).

Note the map unit symbols that are in that area. The **Contents** lists the map units by symbol and name and shows the page where each map unit is described.

See the Contents for sections of this publication that may address your specific needs.



This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1988. Soil names and descriptions were approved in 1989. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1989. This survey was made cooperatively by the Natural Resources Conservation Service and the Montana Agricultural Experiment Station. It is part of the technical assistance furnished to the Teton County Conservation District and the Pondera County Conservation District.

The most current official data are available through the NRCS Soil Data Mart website at http://soildatamart.nrcs.usda.gov. Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: A typical area of Hanson very cobbly loam, 0 to 4 percent slopes, is in the foreground. Ear Mountain is in the background.

Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at http://www.nrcs.usda.gov.

Contents

Issued 2003

Detailed Soil Map Unit Legend

Summary of Tables

For tables with the most current data, please visit the
Soil Data Mart at **http://soildatamart.nrcs.usda.gov/.**

Soil Survey of
Choteau-Conrad Area; Parts of Teton and Pondera Counties, Montana

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. In addition, this survey can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. To predict soil behavior, field experience and collected data on soil properties and performance are used.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. This information can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Interpretive ratings help engineers, planners, and others understand how soil properties influence important nonagricultural uses, such as building site development and construction materials. The ratings indicate the most restrictive soil features affecting the suitability of the soils for these uses.

Soils are rated in their natural state. No unusual modification of the soil site or material is made other than that which is considered normal practice for the rated use. Although soils may have limitations, it is important to remember that engineers and others can modify soil features or can design or adjust the plans for a structure to compensate for most of the limitations. Most of these practices, however, are costly. The final decision in selecting a site for a particular use generally involves weighing the costs of site preparation and maintenance.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The tables, “Classification of the Soils” and “Acreage and Proportionate Extent of the Soils,” at the end of this section show the classification and extent of the soils in this survey area.

Agronomy

Crops and Pasture

General management needed for crops and for hay and pasture is suggested in this section. The system of land capability classification used by the Natural Resources Conservation Service is explained, and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider obtaining specific information from local Natural Resources Conservation Service or Cooperative Extension Service offices.

About 54 percent of the survey area is cropland. There are about 801,000 acres of dryland farming and 280,000 acres of irrigated farming. Most of the dryland farming occurs in the eastern part of the survey area where climate and soils are well suited to crops. Dryland farming is discussed below, followed by a discussion of irrigated farming.

Dryland Farming

The two main dryland crops are barley and wheat. In recent years, spring wheat and winter wheat have been equally important. Other crops seeded are alfalfa hay, durum wheat, grass for hay and pasture, malting barley, oats, and triticale.

Conserving soil moisture—Most of the survey area does not receive enough annual precipitation to produce a profitable crop every year. A small grain crop-fallow-rotation system is commonly used to assure a successful crop. In this rotation, the soil moisture accumulated after harvest of the previous crop and during the fallow period is critical to the yield of the next crop. Each additional inch of stored soil moisture helps to produce an estimated 5 to 7 bushels of barley or 4 to 5 bushels of wheat.

In a crop-fallow-rotation system, some soils, such as sandy or very shallow soils, are not capable of storing all of the snow and rain moisture until the next crop. Water is lost by deep percolation below the crop root zone, or it is lost by runoff where the infiltration rate of precipitation is slow. These soils are sometimes cropped every year since accumulated moisture from summer fallow is lost to the crop. Management practices that help conserve moisture include leaving the stubble stand over the first winter after harvest and reducing tillage operations. Good weed control is essential. Also effective is leaving 30 percent or more of the residue on the surface during the fallow year and planting moisture-efficient crops and varieties. Barley is generally more moisture efficient than spring wheat. Semidwarf varieties of spring wheat are generally more efficient than tall varieties in terms of their ability to convert soil moisture into bushels of grain.

Occasionally, recropping may be more profitable than the traditional crop-fallow-rotation system when enough soil moisture is accumulated after harvest and over the winter. Though the science is not exact, generally two feet of moist soil, measured by probing in medium- to heavy-textured soils, is considered enough to produce an adequate crop in most years. Two feet of moist soil is equal to between 3½ and 4½ inches of stored soil moisture. Also, growing-season precipitation must be expected to be normal or near normal for a successful crop. Additional fertilizer is needed to recrop since most of the nutrients normally released from the breakdown of crop residue are still contained in the residue of a crop-fallow-rotation system.

Reducing soil blowing—Soil blowing is a problem in most cultivated soils of a crop-fallow-rotation system. Most soil blowing takes place from November through May, after the fallow season. Soil blowing is especially a problem early in the spring when there are persistent strong winds. Unless well managed, sands and clays are readily eroded during this period. Loamy soils can also erode if they are cultivated in wide strips or in blocks during dry periods when the wind velocity is high. Loss of the surface layer through erosion affects soil productivity, soil tilth, available water-holding capacity, rooting depth, and sediment load in streams. In addition, surface-layer loss often indirectly affects crop yields by removing or displacing chemical fertilizers and pesticides and contributes to chemical pollution of surface waters.

Management practices that help reduce soil blowing include alternating strips of crop and fallow; maintaining a cloddy or ridged surface; maintaining crop residues on the soil surface with mulch or reduced tillage; planting wind barriers, such as trees or tall wheatgrass rows; recropping when feasible; reducing tillage speeds; using grasses and legumes in the rotation; and using low-crown shovels and sweeps.

The primary methods used to reduce soil blowing are combining the proper width of wind strips and maintaining adequate crop residues on the soil surface. The amount of crop residue needed for good protection varies with climate, size of the field, soils, and topography.

Within the survey area, there are enough differences in precipitation and wind velocity to cause significantly different erosion hazards from area to area. For specific information, contact the local Natural Resources Conservation Service office.

An important management concern is how to reduce water erosion. Runoff causes erosion on most of the cropland with slopes of 2 percent or more. However, the majority of water erosion takes place on cropland with slopes of 6 percent or more. The factors that contribute to water erosion are climate, crop and residue management, percent slope, slope length, and soil type. The survey area is also influenced heavily by Chinook winds. Chinooks cause snowmelt and runoff to occur very quickly, increasing the water erosion hazard. Of these factors, the operator can only change slope length and crop and residue management.

Practices that reduce slope length are diversion ditches and terraces. Diversion ditches, usually consisting of grasses or rocky areas, are used to divert runoff water from uphill areas. Water is carried away from cropland to grassed areas or grassed waterways in the field in order to prevent gullying. Terraces are generally used to hold runoff water on the field to prevent gullying, as well as to improve crop production. However, neither practice is common in this survey area due to the expense of construction and the maintenance required. Also, much of the topography in the area is too irregular for the practical farming of terraced fields.

A grassed waterway is an excellent method to carry runoff water through a cropped field and avoid gullying. Farm equipment must be raised when crossing the waterway. The only maintenance required is mowing or harvesting the grass in order to prevent deep snowpacks from forming in the waterway. Rapid melting of deep snowpacks can cause gullying even within a grassed waterway.

Practices that are commonly used to reduce water erosion are related to crop and residue management. On livestock farms, good hay and pasture crops in rotation with small grains help reduce soil loss to an acceptable level. On grain farms, practices include cross-slope farming, field stripcropping with grass-buffer strips, contour stripcropping, and maintaining crop residues on the soil surface. Leaving crop residues on the surface helps to reduce erosion by protecting the soil from raindrop splash and reducing overland transport of soil. Before water begins to run off, crop residues increase water infiltration into the soils.

Controlling soil salinity—Saline seeps result when excess water moves through a saline soil, commonly formed in glacial till, and collects on tips of impermeable underlying shale or bedrock. The problem of excess water occurs mainly in areas of crop-fallow dryland farming. During fallow periods, more water is stored in the soils than can be used by the crop. The excess water then percolates below the root zone of the crop and dissolves salts in the soil or parent material below. When excess water reaches the impermeable layer below, it begins to move laterally and downslope, dissolving more salts and resurfacing to form saline seep. These seeps are commonly too wet to farm across and too time consuming to farm around. The areas that can be farmed are generally nonproductive. Once formed, saline seeps may increase in size at the rate of 5 to 10 percent per year.

On nonirrigated cropland, the most effective solution to the saline seep problem is to recrop or establish grasses and legumes in the recharge area. The recharge area is an area of excess water accumulation and is usually at least ten times the size of the existing seep itself.

Early detection of potential saline seep areas is needed so that the problem can be corrected. New or developed wet spots, areas of late-maturing crops, and the prolific growth of foxtail barley or kochia all indicate areas that should be examined for soil salinity. Examination can be done by soil probing and soil sampling. Identified seep areas may be complex with more than one recharge area involved. These should be investigated with a drill rig. Several shallow wells are placed in suspected recharge areas to determine the direction of water flow into the seep area. For specific information on these procedures, contact the local Natural Resources Conservation

Service office or the Montana Salinity Control Association.

Irrigated Farming

There are about 76,000 acres in Pondera County and 204,000 acres in Teton County of irrigated cropland. The irrigated land is used mainly for malting barley, feed barley, spring wheat, and hayland and pasture production. The most common needs in managing irrigated soils are practices for efficient water use, controlling erosion, and maintaining productivity and soil tilth.

The three largest irrigated areas of the survey area are located in the south-central part on the Greenfield and Sunnyslope Benches, with water diverted from the Sun River; the central part on the Burton Bench, with water diverted from the Teton River; and the north-central part on terraces and benches, with water diverted from Birch Creek.

Efficient application and conservation of water is essential to farming in the two counties. Water supplies come from upstream storage captured each spring as mountain snowpacks melt. The method of applying water to the soil needs to be compatible with soil intake rates, soil slopes, vegetative cover, volume of available water, and time required to irrigate. Successful management also depends on knowing the correct time to irrigate and the amount of water to apply. As a general rule, small grain and forage crops should be irrigated when half of the available soil moisture has been used. The objective of irrigation-water management is to apply water to the soil in a way that meets the crop needs, without excessive water loss through deep percolation or runoff. Maintaining water quality in ground water and streams is a major concern. Deep percolation is not only a water-loss problem but can also contribute to the leaching of plant nutrients, pesticides, and salts into ground water. Excess runoff can concentrate salts, along with fertilizers and pesticides, into tailwater and streams.

Irrigation is applied through contour-ditch, random-ditch, graded-border (border-dike), and sprinkler systems. Contour-ditch systems convey water through evenly spaced field ditches installed on the contour. Random-ditch systems convey water through field ditches along the high areas within a field. Fields having adequate soil depth and gentle topographic relief can be leveled to graded-border systems. Graded-border systems have the highest irrigation efficiencies of a surface system.

Water runoff can cause sheet erosion, rill erosion, and gully erosion. Excessive volumes in return-flow channels can cause erosion and water-quality problems downstream. Water erosion is caused by runoff from irrigating too frequently, continuing to apply water after the profile is saturated, or applying volumes that are too large. These runoff and water-erosion problems become greater as the slopes increase. Contour-ditch irrigation can be suitable on soils with slopes up to 15 percent. Water erosion can be a hazard on slopes as low as 6 percent. On slopes of 6 percent or more, close contour-ditch spacing and permanent vegetative cover will reduce erosion potential. Runoff and erosion are minimized if the volume of water and set time meet the surface-system design. Improperly designed sprinkler systems, especially on low-intake soils, can cause erosion from runoff. Proper sizing of sprinkler nozzles and proper length of sets are needed to eliminate runoff from sprinkler systems.

Continuous small-grain production and removing crop residue through bailing or burning can cause a deficiency of nitrogen and phosphorus. Potassium deficiencies may occur if overirrigation has taken place for twenty years or more, particularly in sandy soils. High potassium-using crops, like legumes, will show potassium deficiency long before small grains. Fertilization is necessary for high crop yields on irrigated soils. Inclusion of legumes in the cropping system will help soil tilth and correct part of the nitrogen deficiency. Mineral fertilizers can be applied to provide required nitrogen, phosphorus, and potassium levels. Amounts and timing should be done according to tests on the soils. When feasible, all crop residue should be returned to the soil. Crop residue will return some nutrients to the soil and increase organic matter. Also, crop residue will improve soil structure and increase the water intake of most soils. Contact the local Natural Resources Conservation Service office for more detailed information.

Cropland Limitations and Hazards

Management concerns affecting the use of the detailed soil map units in the survey area for crops are shown in the table, “Main Cropland Limitations and Hazards.” The main concerns in managing nonirrigated cropland are conserving moisture, controlling soil blowing and water erosion, and maintaining soil fertility.

Conserving moisture consists primarily of reducing the evaporation and runoff rates and increasing the

water infiltration rate. Applying conservation tillage and conservation-cropping systems, establishing field windbreaks, farming on the contour, leaving crop residue on the surface, and stripcropping conserve moisture.

Generally, a combination of several practices is needed to control *soil blowing* and *water erosion*.

Conservation-cropping systems, conservation tillage, contour farming, crop-residue management, diversions, field windbreaks, grassed waterways, stripcropping, and tall grass barriers help to prevent excessive soil loss.

Measures that are effective in maintaining *soil fertility* include applying fertilizer, both organic and inorganic, including manure; incorporating crop residue or green-manure crops into the soil; and using proper crop rotations. Controlling erosion helps to prevent the loss of organic matter and plant nutrients. All soils used for nonirrigated crops respond well to applications of fertilizer.

Some of the limitations and hazards shown in the table cannot be easily overcome. These are *channels, depth to rock, flooding, gullies, lack of timely precipitation*, and *ponding.*

Additional limitations and hazards are as follows:

Areas of rock outcrop and slickspots—Farming around these areas may be feasible. Subsoiling or deep ripping soft sedimentary beds increases the effective rooting depth and the rate of water infiltration.

Excessive permeability—This limitation causes deep leaching of nutrients and pesticides. The capacity of the soil to retain moisture for plant use is poor.

Lime content, limited available water capacity, poor tilth, restricted permeability, and *surface crusting*—These limitations can be overcome by incorporating crop residue, green-manure crops, or manure into the soil; applying a system of conservation tillage; and using conservation-cropping systems. Also, crops may respond well to additions of phosphate fertilizer to soils that have a high content of lime.

Potential for ground-water pollution—This limitation is a hazard in soils with excessive permeability, hard bedrock, or a water table within the profile.

Short frost-free period—If the growing season is less than 90 days, short-season crops or grasses should be grown.

Slope—Where the slope is more than 8 percent, soil blowing and water erosion may be accelerated unless conservation-farming practices are applied.

Surface rock fragments—This limitation causes rapid wear of tillage equipment; it cannot be easily overcome.

Surface stones—Stones or boulders on the surface can hinder normal tillage unless they are removed.

Salt and sodium content—In areas where this is a limitation, only salt- and sodium-tolerant crops should be grown.

On irrigated soils, the main management concerns are *efficient water use, nutrient management, control of erosion, pest and weed control*, and *timely planting and harvesting* for a successful crop. An irrigation system that provides optimum control and distribution of water at minimum cost is needed. Overirrigation wastes water, leaches plant nutrients, and causes erosion. Overirrigation can also create drainage problems, raise the water table, and increase soil salinity.

Following is an explanation of the criteria used to determine the limitations or hazards.

Areas of rock outcrop—Rock outcrop is a named component of the map unit.

Areas of rubble land—Rubble land is a named component of the map unit.

Areas of slickspots—Slickspots are a named component of the map unit.

Channeled—The word “channeled” is included in the name of the map unit.

Depth to rock—Bedrock is within a depth of 40 inches.

Excessive permeability—The upper limit of the permeability range is 6 inches or more within the soil profile.

Flooding—The component of the map unit is occasionally flooded or frequently flooded.

Gullied—The word “gullied” is included in the name of the map unit.

Lack of timely precipitation—The component of the map unit has a xeric moisture regime, and the amount of annual precipitation is no more than 14 inches.

Lime content—The component is assigned to wind erodibility group 4L or has more than 5 percent lime in the upper 10 inches. Wind erodibility groups are defined in the “Soil Properties” section.

Limited available water capacity—The available water capacity calculated to a depth of 60 inches or to a root-limiting layer is 5 inches or less.

Ponding—Ponding duration is assigned to the component of the map unit.

Poor tilth—The component of the map unit has more than 35 percent clay in the surface layer.

Potential for ground-water pollution—The soil has a water table within a depth of 4 feet or hard bedrock within the profile, or permeability is more than 6 inches per hour within the soil.

Restricted permeability—Permeability is 0.06 inch per hour or less within the soil profile.

Salt content—The component of the map unit has an electrical conductivity of more than 4 in the surface layer or more than 8 within a depth of 30 inches.

Short frost-free period—The map unit has a growing season of less than 90 frost-free days.

Slope—The upper slope range of the component of the map unit is more than 8 percent.

Sodium content—The sodium adsorption ratio of the component of the map unit is more than 13 within a depth of 30 inches.

Soil blowing—The wind erodibility index multiplied by the selected high C factor for the survey area and then divided by the T factor is more than 8 for the component of the map unit.

Surface crusting—The sodium adsorption ratio in the surface layer is 5 or more for any texture and 4 or more if the texture is silt, silt loam, loam, or very fine sandy loam.

Surface rock fragments—The terms describing the texture of the surface layer include any rock fragment modifier except for gravelly or channery, and “surface stones” is not already indicated as a limitation.

Surface stones—The terms describing the texture of the surface layer include any stony or bouldery modifier or the soil is a stony or bouldery phase.

Water erosion—The surface K factor multiplied by the upper slope limit is more than 2 (same as prime farmland criteria).

Water table—The component of the map unit has a water table within a depth of 60 inches.

Crop Yield Estimates

The average yields per acre that can be expected of the principal crops under a high level of management are shown in the table, “Land Capability and Yields per Acre of Crops and Pasture.” In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit is shown in the table.

Forage crop yields are estimates based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include improving drainage; controlling erosion; protecting areas from flooding; selecting proper planting and seeding rates; choosing suitable high-yielding crop varieties; appropriately and timely tilling; controlling weeds, plant diseases, and harmful insects; ensuring favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effectively using crop residue, barnyard manure, and green-manure crops; and harvesting to ensure the smallest possible loss. Yields for dryland crops are based on a crop-fallow-rotation system.

For provided yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the forage crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in the table are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. Local offices of the Natural Resources Conservation Service or the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Pasture and Hayland Management

Soils are assigned to pasture and hayland groups according to their suitability for the production of forage. The soils in each group are similar enough to be suited to the same species of grasses or legumes, have similar limitations and hazards, require similar management, and have similar productivity levels and other responses to management.

Under good management, proper grazing is essential for the production of high-quality forage, stand survival, and erosion control. Proper grazing helps plants to maintain sufficient and generally vigorous top growth during the growing season. Brush control is essential in many areas, and weed control generally is needed. Rotation grazing and renovation also are important management practices.

Yield estimates are often indicated in animal unit months (AUM), or the amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

Local offices of the Natural Resources Conservation Service or the Cooperative Extension Service can provide information about forage yields

other than those shown in the table, “Land Capability and Yields per Acre of Crops and Pasture.”

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, or for engineering purposes.

In the capability system, as described in “Land Capability Classification” (U.S. Department of Agriculture, 1961), soils generally are grouped at three levels: capability class, subclass, and unit. These levels indicate the degree and kinds of limitations affecting mechanized farming systems that produce the more commonly grown field crops, such as corn, small grains, hay, and field-grown vegetables. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use.

If properly managed, soils in classes 1, 2, 3, and 4 are suitable for the mechanized production of commonly grown field crops and for pasture and woodland. The degree of the soil limitations affecting the production of cultivated crops increases progressively from class 1 to class 5. The limitations can affect levels of production and the risk of permanent soil deterioration caused by erosion and other factors.

Soils in classes 5, 6, and 7 are generally not suited to the mechanized production of commonly grown field crops without special management, but they are suitable for plants that provide a permanent cover, such as grasses and trees. The severity of the soil limitations affecting crops increases progressively from class 5 to class 7. Local offices of the Natural Resources Conservation Service or the Cooperative Extension Service can provide guidance on the use of these soils as cropland.

Areas in class 8 are generally not suitable for cropland, pasture, or woodland without a level of management that is impractical. These areas may have potential for other uses, such as recreational facilities and wildlife habitat.

Capability subclasses indicate the dominant limitations in the class. These subclasses are designated by adding a letter, *E, W, S,* or *C,* to the class numeral, for example, 2E. The letter *E* shows that the main hazard is the risk of erosion unless a close-growing plant cover is maintained; *W* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *S* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *C*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

There are no subclasses in class 1 because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *W, S,* or *C* because the soils in class 5 are subject to little or no erosion. Class 5 soils have other limitations that restrict their use mainly to pasture, rangeland, recreation, wildlife habitat, or woodland.

The capability classification of each map unit is given in the table, “Land Capability and Yields per Acre of Crops and Pasture.”

Prime Farmland and Other Important Farmland

In this section, prime farmland and other important farmland are defined. The soils in the survey area that are considered prime farmland are listed in the table, “Prime Farmland.”

Prime Farmland

Prime farmland is of major importance in meeting the Nation’s short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our Nation’s prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to food, feed, forage, fiber, and oilseed crops. Such soils have properties that favor the economic production of sustained high yields of crops. The soils need only to be treated and managed by acceptable farming methods. An adequate moisture supply and a

sufficiently long growing season are required. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be used as cropland, pasture, woodland, or for other purposes. They either are used for food and fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as commercial, housing, and industrial sites; sites for institutions or public buildings; small parks; golf courses; cemeteries; railroad yards; airports; sanitary landfills; sewage treatment plants; and water-control structures. Public land is land not available for farming in military reservations, national forests, national parks, and state parks.

Prime farmland soils commonly receive an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable, and the level of acidity or alkalinity and the content of salts and sodium are acceptable. The soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods, and they are not frequently flooded during the growing season or are protected from flooding. Slopes range mainly from 0 to 6 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland where these limitations are overcome by drainage measures, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. The local office of the Natural Resources Conservation Service can provide more information about the criteria for prime farmland.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on lands that are less productive than prime farmland.

The map units in the survey area that meet the requirements for prime farmland are listed in the table, “Prime Farmland.” On some soils included in the table, measures that overcome limitations are needed. The need for these measures is indicated in parentheses after the map unit name. The location of each map unit is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described in the “Soil Series and Detailed Soil Map Units” section. This list does not constitute a recommendation for a particular land use.

Unique Farmland

Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops. It has the special combination of soil qualities, location, growing season, and moisture supply needed for the economic production of sustained high yields of a specific high-quality crop when treated and managed by acceptable farming methods.

Unique farmland is used for a specific high-value food or fiber crop; has an adequate supply of available moisture for the specific crop because of irrigation, precipitation, or stored moisture; and has a combination of air drainage, aspect, elevation, growing season, humidity, soil qualities, temperature, and other factors, such as nearness to markets, that favors the production of a specific food or fiber crop.

Lists of unique farmland are developed as needed in cooperation with conservation districts and others.

Additional Farmland of Statewide Importance

Some areas other than areas of prime and unique farmland are of statewide importance in the production of food, feed, fiber, forage, and oilseed crops. The criteria used in defining and delineating these areas are determined by the appropriate state agency or agencies. Generally, additional farmland of statewide importance includes areas that nearly meet the criteria for prime farmland and that economically produce high yields of crops when treated and managed by acceptable farming methods. Some areas can produce as high a yield as areas of prime farmland if conditions are favorable. In some states, additional farmland of statewide importance may include tracts of land that have been designated for agriculture by state law.

Farmland of statewide importance is included in the list of prime farmland. Criteria is available in the “Montana Field Office Technical Guide” (U.S. Department of Agriculture, Natural Resources Conservation Service, Section II).

Additional Farmland of Local Importance

This land consists of areas that are of local importance in the production of food, feed, fiber, forage, and oilseed crops and are not identified as having nationwide or statewide importance. Where

appropriate, this land is identified by local agencies. It may include tracts of land that have been designated for agriculture by local ordinance.

Lists of this land are developed as needed in cooperation with conservation districts and others.

Erosion Factors

Soil erodibility (K) and soil-loss tolerance (T) factors are used in an equation that predicts the amount of soil lost through water erosion in areas of cropland. The procedure for predicting soil loss is useful in guiding the selection of soil and water conservation practices.

Soil Erodibility (K) Factor

The soil erodibility factor (K) indicates the susceptibility of a soil to sheet and rill erosion by water. The soil properties that influence erodibility are those that affect the infiltration rate, the movement of water through the soil, and the water storage capacity of the soil and those that allow the soil to resist dispersion, splashing, abrasion, and the transporting forces of rainfall and runoff. The most important soil properties are the content of silt plus very fine sand; the content of sand coarser than very fine sand; and the content of organic matter, soil structure, and permeability.

Fragment-Free Soil Erodibility (Kf) Factor

This is one of the factors used in the revised Universal Soil Loss Equation. Kf factor shows the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Soil-Loss Tolerance (T) Factor

The soil-loss tolerance factor (T) is an estimate of the maximum annual rate of soil erosion that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons of soil loss per acre per year. Ratings of 1 to 5 are used, depending on soil properties and prior erosion. The criteria used in assigning a T factor to a soil include maintenance of an adequate rooting depth for crop production, potential reduction of crop yields, maintenance of water-control structures affected by sedimentation, prevention of gullying, and the value of nutrients lost through erosion.

Wind Erodibility Groups

Wind erodibility is directly related to the percentage of dry, nonerodible surface soil aggregates larger than 0.84 millimeter in diameter. From this percentage, the wind erodibility index factor (I) is determined. This factor is an expression of the stability of the soil aggregates, or the extent to which they are broken down by tillage and the abrasion caused by windblown soil particles. Soils are assigned to wind erodibility groups (WEG) having similar percentages of dry soil aggregates larger than 0.84 millimeter. Wind erodibility groups are defined in the “Soil Properties” section.

Local offices of the Natural Resources Conservation Service or the Cooperative Extension Service can provide additional information about wind erodibility groups and K, Kf, T, and I factors.

Windbreaks and Environmental Plantings

Windbreaks protect buildings, cropland, fruit trees, gardens, livestock, and yards from wind and snow; help to keep snow on fields; and provide food and cover for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well-prepared site and maintained in good condition.

Windbreaks are often planted on land that did not originally support trees. Knowledge of how trees perform on such land can be gained only by observing and recording the performance of planted trees that have survived. Many popular windbreak species are not indigenous to the areas in which they are planted.

Each tree or shrub species has certain climatic and physiographic limits. Within these parameters, a tree or shrub may grow well or poorly, depending on the characteristics of the soil. Each tree or shrub has

definable potential heights in a given physiographic area and under a given climate. Accurate definitions of potential heights are necessary when a windbreak is planned and designed.

The “Windbreak Suitability Groups Species List” table shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in this table are based on measurements and observations of established plantings that have been given adequate care. They can be used as a guide in planning screens and windbreaks. Additional information on planning screens and windbreaks and planting and caring for trees and shrubs can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service or from a nursery.

Windbreak Suitability Groups

Windbreak suitability groups consist of soils in which the kinds and degrees of the hazards or limitations that affect the survival and growth of trees and shrubs in windbreaks are about the same.

Group 1 consists of soils that have no soil-related hazards or limitations or only slight hazards or limitations if they are used for windbreaks. Slopes are less than 15 percent.

Group 2M consists of soils that have a moderate available water capacity (5 to 10 inches) because of texture, depth, or both. The soils are well drained and not affected by salinity. A layer of concentrated lime, if it occurs, is below a depth of 24 inches. Slopes are less than 15 percent.

Group 2L consists of soils that have a layer of concentrated lime (more than 15 percent calcium carbonate equivalent) at a depth of about 15 to 24 inches. Available water capacity is at least 5 inches. Soils are well drained and not affected by salinity or alkalinity. (Electrical conductivity is less than 4 millimhos per centimeter.) Slopes are less than 15 percent.

Group 2W consists of soils that have an available water capacity of 5 inches or more. If the soils have a layer of concentrated lime, the layer is below a depth of 15 inches. Depth to a permanent water table is 30 to 60 inches. Soils are not affected by salinity. Slopes are less than 15 percent.

Group 2S consists of soils that are moderately affected by salinity. (Electrical conductivity is 4 to 12 millimhos per centimeter.) Available water capacity is at least 5 inches. A layer of concentrated lime, if it occurs, is at a depth of 15 inches or more. The water table is at a depth of 30 inches or more. Slopes are less than 15 percent.

Group 3M consists of soils that have an available water capacity of 2 to 5 inches because of texture, depth, or both. A layer of concentrated lime, if it occurs, is at a depth of 15 inches or more. Soils are well drained and not affected by salinity. (Electrical conductivity is less than 4 millimhos per centimeter.)

Group 3L consists of soils that have a layer of concentrated lime (more than 15 percent calcium carbonate equivalent) at a depth of less than 15 inches. A permanent water table is at a depth of more than 30 inches. Available water capacity is more than 5 inches. Soils are not affected by salinity. (Electrical conductivity is less than 4 millimhos per centimeter.) Slopes are less than 15 percent.

Group 3W consists of soils that have an available water capacity of 2 inches or more. If the soils have a layer of concentrated lime, the layer is below a depth of 15 inches. Depth to a permanent water table is 30 inches or less. The water table is more than 10 inches during all or most of the growing season. Soils are not affected by salinity. Slopes are less than 15 percent.

Group 3S consists of soils that are severely affected by salinity or alkalinity. (Electrical conductivity is 12 to 16 millimhos per centimeter.) Available water capacity is 5 inches or more. A layer of concentrated lime, if it occurs, is at a depth of more than 15 inches. A permanent water table is at a depth of 30 inches or more. Slopes are less than 15 percent.

Group 4 consists of soils that have slopes of more than 15 percent, except for soils in areas where the length of the slopes is 100 feet or less and the less sloping soils have very severe limitations, including soils that have a very low available water capacity (2 inches or less); very shallow, stony, or gravelly soils; strongly saline and alkali soils, in which the electrical conductivity is more than 16 millimhos per centimeter; and soils that have a pH of more than 9.0. Rock outcrop is also in this group.

Windbreak Suitability Groups Recognized in Teton and Pondera Counties

Group 1 consists of well-drained and moderately well-drained, deep soils. Available water capacity in the upper 5 feet is usually more than 10 inches. Zones of concentrated lime, if they occur, are below 24 inches. The amount of potentially detrimental salts

is low. Slopes range from 0 to 15 percent. Average annual precipitation is 11 to 20 inches. Average growing season is 60 to 125 days.

Limitations to the establishment and development of windbreaks are few. In dryland areas, particularly grassy areas, summer fallow is needed before planting. Continual cultivation of the windbreak or shelterbelt to conserve moisture is suggested to insure maximum development. Irrigation increases growth of all trees and shrubs. Control of runoff from rainfall and snowmelt may be needed to prevent excessive erosion on the steeper slopes.

Group 2M consists of well-drained, moderately deep and deep soils. Available water capacity in the upper 5 feet ranges from 5 to 10 inches. Zones of concentrated lime, if they occur, are below 24 inches. The amount of potentially detrimental salts is low. Slopes range from 0 to 15 percent. Average annual precipitation is 11 to 20 inches. Average growing season is 60 to 125 days.

Limitations to the establishment and development of windbreaks are moderate. In dryland areas, the moderate available water capacity is the chief limitation to planting. This limitation can be overcome by cultivating grasses and weeds to eliminate water consumption and by properly selecting, arranging, and spacing tree and shrub species.

Fallow provides moisture for initial growth and good establishment of windbreaks. Two seasons of summer fallow are suggested for plantings in sodded areas. Erosion control may be needed during this fallow period on soils that have a surface texture of sandy loam or coarser. Plans should be made to control water erosion from runoff on the steeper slopes.

Group 2L consists of well-drained, moderately deep and deep soils. Available water capacity ranges from 5 to 10 inches or more in the upper 5 feet. Soils in this group have a concentrated lime zone at a depth of 15 to 24 inches. The amount of potentially detrimental salts is low. Slopes are less than 15 percent. Average annual precipitation is 11 to 20 inches. Average growing season is 60 to 125 days.

The main consideration in planting farmstead and field windbreaks on these soils is the tolerance of the species to high lime concentrations. This limitation restricts the choice of species. A fallow season is necessary to eliminate grasses and weeds and allow a moisture reserve to build up in the subsoil. On dryland sites, one year of summer fallow is needed on cropland while two years is needed on native or introduced sod.

Group 2S consists of well-drained and moderately well-drained, deep soils. Available water capacity in the upper 5 feet ranges from 5 to 10 inches. Zones of concentrated lime, if they occur, are below 15 inches. The amount of detrimental salts is medium. Slopes range from 0 to 8 percent. Average annual precipitation is 11 to 19 inches. Average growing season is 90 to 125 days.

Concentration of salts is the chief limitation to planting. Because salts are detrimental to plant growth, the choice of species is limited. Windbreak establishment may be more difficult and growth may be below average.

Group 2W consists of moderately well-drained or somewhat poorly drained, deep soils. These soils have a fluctuating water table that is below a depth of 4 feet during the majority of the growing season. In most years, the water table is also above a depth of 3 feet for a short period. Zones of concentrated lime, if they occur, are below 15 inches. The amount of potentially detrimental salts is low. Slopes are mainly less than 4 percent. Average annual precipitation is 11 to 20 inches. Average growing season is 60 to 125 days.

The main consideration in planting farmstead and field windbreaks on these soils is resistance of the species to wet soil conditions. This limitation restricts the choice of species.

Group 3M consists of well-drained, deep or moderately deep shallow soils. Available water capacity in the upper 5 feet ranges from 2 to 5 inches. Zones of concentrated lime, if they occur, are below 15 inches. The amount of potentially detrimental salts is low. Slopes range from 0 to 15 percent. Average annual precipitation is 11 to 20 inches. Average growing season is 60 to 125 days.

In dryland areas, the chief limitation to the establishment of trees and shrubs is the low available water capacity. This limitation can be overcome in irrigated areas with frequent irrigation. Low available water capacity restricts the choice of species. Seedling mortality is moderate to high, and replanting may be needed to establish a full stand. Growth rates are reduced.

Plans should be made to control water erosion from runoff on the steeper areas. In order to provide adequate moisture for dryland plantings in sodded areas, two seasons of summer fallow are suggested. Soil blowing control may be needed in the fallow period on soils that have a surface texture of sandy loam or coarser.

Group 3L consists of well-drained, moderately deep and deep soils. These soils have a concentrated lime zone at a depth of less than 15 inches. The surface layer is noncalcareous to strongly calcareous. Slopes are less than 15 percent.

In the upper 5 feet, available water capacity ranges from 5 to 10 inches or more. Average annual precipitation is 11 to 20 inches. Average growing season is 60 to 125 days.

The main consideration in planting farmstead and field windbreaks on these soils is resistance of the species to high lime concentrations. A fallow period is recommended for dryland farming site preparation. This period is necessary to eliminate grasses and weeds and allow a moisture reserve to build up in the subsoil. One year of summer fallow is recommended on cropland; two years is recommended on native or introduced sod.

Group 3S consists of well-drained and moderately well-drained, deep soils. Available water capacity in the upper 5 feet ranges from 5 to 9 inches. Zones of concentrated lime, if they occur, are below 15 inches. The amount of potentially detrimental salts is high. Slopes range from 0 to 8 percent. Average annual precipitation is 11 to 19 inches. Average growing season is 90 to 125 days.

The severe concentration of salts is the chief limitation to planting. Choice of species is limited since salts are detrimental to most plant growth. Windbreak establishment may be difficult, and growth may be below average.

Group 3W consists of poorly drained, deep soils. These soils have a fluctuating water table that is below a depth of 2 feet for most of the growing season. In most years, the water table is also above a depth of 2 feet for short periods. Zones of concentrated lime, if they occur, are below 15 inches. The amount of potentially detrimental salts is low. Slopes range from 0 to 2 percent. Average annual precipitation is 11 to 20 inches. Average growing season is 60 to 125 days.

Soil wetness caused by poor drainage is the chief limitation to planting. This limitation severely restricts the choice of species. Soil wetness also makes the establishment and care of trees and shrubs difficult.

Group 4 consists of steep sloping soils with very low available water capacity. These soils have dispersed clays and are very poorly drained. Many of the soils are limited by two or more factors.

These soils generally are not suited to farmstead and field windbreaks. However, many of these soils are mapped in complexes with soils that are suited to windbreaks. Onsite inspections are needed to determine possible suitable locations of windbreaks.

Range

Rangeland and grazeable woodland make up about 41 percent, or 826,000 acres, of Teton and Pondera Counties. These land uses occur in the western part of the survey area where the climate, slopes, and soils generally are not suited to crop cultivation. Cattle and sheep are the most common livestock in the area. The chief vegetation consists of forbs, grasslike plants, native grasses, and shrubs. The main landforms are hills, piedmont glacial plains, sedimentary plains, and stream terraces. Soils that commonly occur are the Cabba, Cabbart, Castner, Delpoint, Kiev, Roundor, Wayden, Windham, Winifred, and Winspect series.

Large areas of the range in this survey area have a history of heavy grazing use, resulting in changes in plant species composition and reductions in forage yields. Proper range renovation and management are needed to improve range in poor condition.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on range are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Range is defined as land on which the native vegetation (the climax, or natural potential, plant community) is predominantly grasses, grasslike plants, forbs, and shrubs suitable for grazing and browsing. Range includes natural grasslands, savannas, many wetlands, some deserts, tundra, and certain shrub and forb communities. Range receives no regular or frequent cultural treatment. The composition and production of the plant community are determined by soil, climate, topography, overstory canopy, and grazing management (U.S. Department of Agriculture, 1976).

Grazed forest land is defined as land on which the understory includes, as an integral part of the forest plant community, plants that can be grazed without significant impairment of other forest values.

Native pasture is defined as land on which the potential (climax) vegetation is forest but which is used and managed primarily for the production of native forage plants. Native pasture includes cutover forest land and forest land that has been cleared and is managed for native or naturalized forage plants (U.S. Department of Agriculture, 1976).

The table, "Rangeland and Grazeable Understory—Productivity and Characteristic Plant Communities," shows, for each listed soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. Explanation of the column headings in this table follows.

Range site is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants.

Many different range sites are in the survey area. Over time, the combination of plants best suited to a particular soil and climate has become established. If the soil is not excessively disturbed, this group of plants is the natural plant community for the site. Natural plant communities are not static but vary slightly from year to year and place to place.

The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

The "Montana Field Office Technical Guide," (U.S. Department of Agriculture, Natural Resources Conservation Service, Section II) available at local offices of the Natural Resources Conservation Service, can provide specific information about range sites.

Total production is the amount of vegetation that can be expected to grow annually on well-managed range that is supporting the historic natural plant community. It includes all vegetation—the current year's growth of leaves, twigs, and fruit of woody

plants—whether or not it is palatable to grazing animals. Total annual production does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation, along with temperature, make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as amount of shade, exposure, recent rains, and unseasonable dry periods.

Characteristic vegetation consists of the forbs, grasses, and shrubs that make up most of the potential natural plant community on each soil. The plants are listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the canopy, the density of the canopy, and the depth and condition of the litter. The density of the canopy determines the amount of light that understory plants receive.

Range Condition

Range condition is based on a comparison of the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the natural community, the better the range condition.

Abnormal disturbances that change the natural plant community include repeated overuse by livestock, excessive burning, erosion, and plowing. Grazing animals select the most palatable plants. These plants will eventually die if they are continually grazed. A very severe disturbance can destroy the natural community. Under these conditions, less desirable plants, such as annuals and weeds, can invade. If the plant community has not deteriorated significantly, it eventually can return to dominantly natural plants if proper grazing management is applied.

Four range condition classes are used to show the degree of deterioration of the natural plant community. An area of rangeland is in *excellent condition* if more than 75 percent of the present plant community is the same as the natural plant community. It is in *good condition* if natural plants make up 51 to 75 percent of the present plant community, in *fair condition* if those plants make up 26 to 50 percent, and in *poor condition* if they make up less than 25 percent.

Knowledge of the range site and condition is necessary as a basis for planning and applying the management needed to maintain or improve the desired plant community for selected uses. Such information is needed to determine management objectives, proper grazing systems and stocking rates, suitable wildlife management practices, potential for recreational uses, and condition of watersheds.

Rangeland Management

Rangeland management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site (U.S. Department of Agriculture, 1976). Such management generally results in the optimum production of vegetation, reduction of less desirable species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, protects soil and water resources, and provides wildlife habitat.

Grazing management is the most important part of any rangeland management program. Planned rotation grazing systems, proper grazing use, and timely deferment of grazing are key practices. The experience of ranchers and research has shown that if no more than one-half of the current year's growth is grazed, a plant community in good or excellent condition can be maintained, and one in fair condition can be improved. The remaining one-half enables plants to make and store food for regrowth and root development. As a result, the desirable plants remain healthy and are not replaced by less desirable grasses and weeds. Also, the plant cover helps to control runoff, improves tilth, increases the rate of water infiltration, and protects the soil from soil blowing and water erosion.

Certain practices commonly are needed to obtain a uniform distribution of grazing. These practices include constructing livestock trails in steeply sloping areas, developing livestock watering facilities, fencing, properly locating salt and mineral supplements, and riding or herding.

Various kinds of grazing systems can be used in range management. No single grazing system is best under all conditions. The grazing system should increase the quantity and improve the quality of the range vegetation; should meet the needs of the individual operator; and should be designed according to resource management objectives, topography, and type of grazing animals.

Special improvement practices are needed in areas where management practices do not achieve the desired results or where recovery is too slow under forage management alone. These practices include brush management, mechanical treatment, prescribed burning, range seeding, and water spreading.

Some soils are suited to mechanical treatment for range improvement. On other soils, however, only proper grazing management can improve the range. The “Agronomy” section defines capability classes. They are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. Many soils in capability classes 1 through 4 are suited to such practices as mechanical brush and weed control, seeding, and water spreading. Those soils in capability classes 7 and 8, however, are not suitable. Many soils in capability classes 1 through 4 are suited to tillage for seedbed preparation before native or introduced forage plant species are seeded. Soils in capability class 6 may be suited to limited surface disturbance, such as scarification, for seeding and as a means of increasing the rate of water infiltration for seed germination.

Where feasible, mechanical renovation practices, such as shallow chiseling, can help to speed recovery of desired plants. These practices open up the surface, allowing absorption of more moisture and production of more desirable plants. Brush management, mechanical renovation, and timely deferment of grazing allow recovery of desired plants.

Seeding may be needed in areas where less desirable plants are dominant. A clean, firm seedbed should be prepared, suitable species should be selected for seeding, and rest periods should be long enough to allow the new plants to become established.

Special improvement practices can be effective only if the management system helps to keep the desirable plants healthy.

Woodland Understory Vegetation

Understory vegetation consists of forbs, grasses, shrubs, and other plants. If well managed, some woodland can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

The quantity and quality of understory vegetation vary with the age and kind of trees in the canopy, the depth and condition of the litter, the density of the canopy, and the kind of soil. The density of the canopy determines the amount of light that understory plants receive.

The table, “Woodland Understory Vegetation and Habitat Types,” shows, for each soil suitable for woodland, the potential for producing understory vegetation. The total production of understory vegetation includes the herbaceous plants and the leaves, twigs, and fruit of woody plants up to a height of 4.5 feet. It is expressed in pounds per acre of air-dry vegetation in favorable, normal, and unfavorable years. In a favorable year, soil moisture is above average during the optimal part of the growing season; in a normal year, soil moisture is average; and in an unfavorable year, it is below average.

The table also lists the common names of the characteristic vegetation on each soil and the composition, by percentage of air-dry weight, of each kind of plant. The table shows the kind and percentage of understory plants expected under a canopy density that is most nearly typical of woodland in which the production of wood crops is highest. The representative habitat type or phase displayed in this table is documented in the “Forest Habitat Types of Montana” (Pfister and others, 1977).

Forest Land

Forest managers can use the “Forest Land Management” and “Forest Land Productivity” tables to plan the use of soils for wood crops. Only those soils suitable for wood crops are listed.

Woodland Ordination System

The table, “Forest Land Management,” lists the ordination (woodland suitability) symbol for each soil. The ordination system is a nationwide uniform system of labeling soils or groups of soils that are similar in use and management. The primary factors evaluated in the woodland ordination system are productivity of the forest overstory tree species and the principal soil properties resulting in hazards and limitations that affect forest management. There are three parts of the ordination system—class, subclass, and group. The class and subclass are referred to as the ordination symbol.

Ordination Class Symbol

The first element of the ordination symbol is a number that denotes potential productivity in terms of cubic meters of wood per hectare per year for the indicator tree species; the larger the number, the greater the potential productivity. Potential productivity is based on site index and the corresponding culmination of mean annual increment. For example, the number 1 indicates a potential production of 1 cubic meter of wood per hectare per year (14.3 cubic feet per acre per year), and 10 indicates a potential production of 10 cubic meters of wood per hectare per year (143 cubic feet per acre per year).

Indicator species is a species that is common in the area and is generally, but not necessarily, the most productive on the soil. It is the species that determines the ordination class. In the “Forest Land Productivity” table, an indicator species is the first species listed for a particular map unit. This table shows the productivity for all species where data have been collected.

Site index is determined by taking height measurements and determining the age of selected trees within stands of a given species (Alexander, 1966). This index is the average height, in feet, that the trees attain in a specified number of years. This index applies to fully stocked, even-aged, unmanaged stands. The site indexes shown in the “Forest Land Productivity” table are averages based on measurements made at sites that are representative of the soil series. When the site index and forest land productivity of different soils are compared, the values for the same tree species should be compared (Dahms, 1964). The higher the site index number, the more productive the soil for that species. Site index values are used in conjunction with yield tables (Myers, 1967) to determine mean annual yields. Indirectly, they are used to determine the productivity class in the ordination class symbol.

Expected tree growth rate and tree diversity on a site are determined by a combination of aspect, climate, elevation, and soils. The ability of soils to support tree growth is dependent on variability in soil depth, fertility, texture, and available water capacity. Forested soils in the area range from shallow to very deep, nongravelly to extremely gravelly, fine textured to coarse textured, and those containing no lime to those containing high amounts of lime.

Listed below is information pertaining to the development of forest land tables in the area. Site index ratings were developed using the following references: black cottonwood (Sauerwein, 1979), Douglas-fir (Brickell, 1968), Engelmann spruce (Alexander, 1967), lodgepole pine (Alexander, 1966), and quaking aspen (Baker, 1925).

Productivity ratings were made based on timber being harvested by the clear-cut method and slash burned. It is assumed that reasonable care was used in logging, so that funneling of skid trails did not occur to concentrate the water; excessive disturbance did not occur; and coarser material from slash disposal remained.

Equipment limitations were related to logging operations. Of prime consideration were difficulties encountered in yarding logs and the influence of logging activities on soil properties. Primary soil features considered for this rating were seasonal soil wetness, slope, soil depth, soil texture, and stoniness.

Seedling mortality ratings apply to planting stock 1 or 2 years of age, with the evaluation period beginning at the time of planting. For natural regeneration, the evaluation period was considered to begin a year after germination.

Windthrow hazard ratings were developed as follows:

Soils on north slopes that remain moist into the spring, and those having a high basal area to limit root development, were considered moderately prone to windthrow even though the soil materials provided a good anchoring medium for tree roots. On drier sites, clayey soils without rock fragments were also considered in this category.

Soils having a high water table (within 20 inches of the surface) long enough to inhibit root development were considered to be severely susceptible to windthrow.

When making ratings for plant competition, the limitation was considered slight if adequate regeneration usually occurs on a soil within 5 years.

For most species, overstory yield estimates were determined from the average annual yield versus site index curves. These curves were developed by adjusting data presented in yield tables published from several different sources. Average annual yield values were computed at the culmination of mean annual increment. Total cubic-foot-volume estimates are based on trees that are more than 4-inch diameter breast height.

“Even-aged Stands of Ponderosa Pine” (Meyer, 1938) was used for estimating yields of Douglas-fir and ponderosa pine. Board-foot volumes are based on Scribner’s log rule and include all trees larger than 10-inch diameter breast height to an 8-inch top diameter inside bark (Dahms, 1964). “Aspen in the Central Rocky Mountain Region” (Baker, 1925) was used to estimate quaking aspen yields.

Ordination Subclass Symbol

The second element, or subclass, of the ordination symbol is a capital letter that indicates certain soil or physiographic characteristics that contribute to important hazards or limitations to be considered in management. The subclasses are defined as follows:

Subclass X indicates that forest-land use and management are limited by stones or rocks.

Subclass W indicates that forest land use and management are significantly limited by excess water, either seasonally or throughout the year. Restricted drainage, a high water table, or flooding can adversely affect either stand development or management.

Subclass T indicates that forest land use and management are limited by a root zone that has toxic substances. Excessive alkalinity, acidity, sodium salts, or other toxic substances impede the development of desirable species.

Subclass D indicates that forest land use and management are limited by a restricted rooting depth. The rooting depth is restricted by hard bedrock, a hardpan, or other restrictive layers in the soil.

Subclass C indicates that forest land use and management are limited by the kind or amount of clay in the upper part of the soil.

Subclass S indicates that forest land use and management are limited by sandy soil, a low available water capacity, and a normally low content of available plant nutrients. The use of equipment is limited during dry periods.

Subclass F indicates that forest land use and management are limited by a high content of rock fragments that are larger than 2 millimeters and smaller than 10 inches. This subclass includes flaggy soils.

Subclass R indicates that forest land use and management are limited by excessive slope.

Subclass A indicates that no significant limitations affect forest land use and management.

Forest Land Management and Productivity

Information about the management and productivity of the forested map units in the survey area is given in the “Forest Land Management” and “Forest Land Productivity” tables.

Management Concerns

In the “Forest Land Management” table, the soils are rated for erosion hazard, equipment limitation, seedling mortality, windthrow hazard, and plant competition.

Erosion hazard is *slight* if there is little or no hazard of erosion, *moderate* if some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive soil loss.

Equipment limitation is *slight* if the use of equipment is not limited to a particular kind of equipment or time of year; *moderate* if there is a short seasonal limitation or a need for some modification in the management of equipment; and *severe* if there is a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings are for seedlings from good planting stock that are properly planted during a period of average rainfall. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Windthrow hazard is *slight* if trees in wooded areas are not expected to be blown down by commonly occurring winds, *moderate* if some trees are blown down during periods of excessive soil wetness and strong winds, and *severe* if many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Plant competition is *slight* if there is little or no competition from other plants; *moderate* if plant competition is expected to hinder the development of a fully stocked stand of desirable trees; and *severe* if plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

Potential Productivity

The potential productivity of merchantable or *common trees* is expressed as a site index, which is described under the heading “Ordination Class Symbol.” Commonly grown trees are those that forest-land managers generally favor in intermediate or improvement cuttings. They are selected based on growth rate, quality, value, and marketability.

The column, *Trees that stands are commonly managed for,* in the “Forestland Productivity” table lists trees that are suitable for commercial wood production and that are suited to the soils.

Main Forest Access Road Limitations and Hazards

The major management concerns affecting the use of the detailed soil map units in the survey area for forest access roads are listed in the “Main Forest Access Road Limitations and Hazards” table. The significance of each limitation or hazard and the criteria used to determine the limitation or hazard are described in this section.

Areas of rock outcrop and *depth to bedrock* can increase the cost of road construction and influence route planning. Constructing roads is difficult because of the need for rock removal and the need for additional soil material to provide a suitable road surface.

Boulders increase the cost of road construction and influence route planning. Construction is difficult mainly because of the need for extraction and disposal of the boulders.

Dustiness of the road surface material may cause safety problems and accelerate equipment wear. Dust-abatement measures are needed during dry periods.

The erodibility of the soil material in the roadbed influences the probability of *erosion by water* resulting from the channeling of runoff in the roadway. Erosion can result in the sedimentation of streams. It can be controlled by reducing road grades and controlling runoff onto and off of the road surface through the installation of drainage measures.

Flooding in the area where a road is constructed may restrict use, result in damage to the roadway, and result in the sedimentation of waterways. The hazard of flooding can be reduced by installing a drainage system, elevating the roadbed, and using riprap and diversions.

Low soil strength of the soil material used to construct the road surface can result in rutting, in drainage problems, and in poor trafficability during wet periods. The road should be used only during dry periods or when the surface is frozen. Surfacing with material of suitable strength and installing a drainage system can help to overcome this limitation.

Roadbed material that has a high *shrink-swell potential* shrinks and swells markedly during dry and wet periods. Excessive shrinking and swelling can damage the road surface or other features, such as bridge abutments, culverts, and erosion-control structures.

A steep *slope* results in increased construction and maintenance costs and increased sedimentation because of the large cuts necessary to create an adequate roadbed. Seeding the cut slope to suitable vegetation minimizes sedimentation. Large cuts can increase instability of the slope. Where slumping is a hazard, slope failure can become a significant maintenance and environmental problem.

Slumping causes safety problems and increases maintenance costs. Frequent clearing of slumped soil in the roadbed or rebuilding of the roadway may be needed to keep the road serviceable and drainage systems functioning.

Stones cause problems in maintaining a smooth road surface that has good trafficability. Unless the stones are removed, additions of suitable stone-free material may be needed when the road is surfaced.

Roads built across soils that have a *water table* may require substantial ballast, fabric, internal drainage systems, and other measures that maintain a road surface that has good trafficability. Construction and use of the road only during periods when the water table is not near the surface or when the road is frozen help to maintain trafficability and reduce the potential for site damage.

Following is an explanation of the criteria used to determine the limitations or hazards.

Areas of Rock outcrop—Rock outcrop is a named component of the map unit.

Areas of Rubble land—Rubble land is a named component of the map unit.

Boulders—The terms describing the texture within a depth of 24 inches include a bouldery modifier, or the soil is a bouldery phase.

Depth to rock—Hard bedrock is within a depth of 60 inches.

Dustiness—The surface layer is silt, silt loam, loam, or very fine sandy loam.

Erosion by water—The surface K factor multiplied by the upper slope limit is more than 10.

Flooding—The component of the map unit is occasionally flooded or frequently flooded.

Low soil strength—The component of the map unit has one of the following Unified classifications (ASTM, 1988) within the 60-inch profile: ML, CL, MH, CH, OL, PT, or GC.

Shrink-swell potential—The component of the map unit has a high shrink-swell potential in a layer that is at least 10-inches thick and is within 40 inches of the surface.

Slope—The upper slope limit is more than 35 percent.

Slumping—The component of the map unit meets the requirements for low soil strength and has slopes of more than 35 percent.

Stones—The terms describing the texture within a depth of 24 inches include a very stony or extremely stony modifier or the soil is a very stony or extremely stony phase.

Water table—The component of the map unit has a water table within a depth of 60 inches.

Recreation

Soils of the survey area are rated in the "Recreational Development" table according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, ability of the soil to support vegetation, access to water, potential water impoundment sites, and either access to public sewer lines or the capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degrees, for recreational uses by the duration of flooding and the season when it occurs. Onsite assessment of the height, duration, intensity, and frequency of flooding is essential in planning recreational facilities.

Camp areas are tracts of land used intensively as sites for tents, trailers, and campers and for outdoor activities that accompany such sites. These areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. Soils are rated based on soil properties that influence the ease of developing camp areas and performance of the areas after development. Also considered are the soil properties that influence trafficability and promote the growth of vegetation after heavy use.

Picnic areas are natural or landscaped tracts of land that are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. Soils are rated based on soil properties that influence the cost of shaping the site, trafficability, and the growth of vegetation after development. The surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Playgrounds are areas used intensively for baseball, football, or similar activities. These areas require a nearly level soil that is free of stones and that can withstand heavy foot traffic and maintain an adequate cover of vegetation. Soils are rated based on soil properties that influence the cost of shaping the site, trafficability, and the growth of vegetation. Slope and stoniness are the main concerns in developing playgrounds. The surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Paths and trails are areas used for hiking and horseback riding. These areas should require little or no cutting and filling during site preparation. Soils are rated based on soil properties that influence trafficability and erodibility. Paths and trails should remain firm under foot traffic and not be dusty when dry.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, not dusty when dry, and not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

The interpretive ratings in this table help engineers, planners, and others to understand how soil properties influence recreational uses. Ratings for proposed uses are given in terms of limitations. Only the most restrictive features are listed. Other features may limit a specific recreational use.

The degree of soil limitation is expressed as slight, moderate, or severe.

Slight means that soil properties are favorable for the rated use. The limitations are minor and can be easily overcome. Good performance and low maintenance are expected.

Moderate means that soil properties are moderately favorable for the rated use. The limitations can be overcome or modified by special planning, design, or maintenance. During some part of the year, the expected performance may be less desirable than that of soils rated *slight*.

Severe means that soil properties are unfavorable for the rated use. Examples of limitations are slope, bedrock near the surface, flooding, and a seasonal

high water table. These limitations generally require major soil reclamation, special design, or intensive maintenance. Overcoming the limitations generally is difficult and costly.

The information in the “Recreational Development” table can be supplemented by other information in this survey, for example, interpretations for dwellings without basements and for local roads and streets in the “Building Site Development” table and interpretations for septic tank absorption fields in the “Sanitary Facilities” table.

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

Elements of Wildlife Habitat

The following paragraphs describe the elements of wildlife habitat.

Grain and seed crops are domestic grains and seed-producing herbaceous plants used by wildlife. Examples of these crops grown in the survey area are barley, oats, rye, and wheat.

Grasses and legumes are domestic perennial grasses and herbaceous legumes planted for wildlife food and cover. Examples of grasses and legumes in the survey area are alfalfa, brome, clover, crownvetch, fescue, orchardgrass, reed canarygrass, timothy, and trefoil.

Wild herbaceous plants are native or naturally established forbs and grasses, including weeds, that provide food and cover for wildlife. Examples of wild herbaceous plants in the survey area are blackberry, blueberry, bluestem, dandelion, fescue, goldenrod, Indiangrass, lambsquarters, nightshade, ragweed, and wheatgrass.

The major soil properties affecting the growth of forage and grain crops and wild herbaceous plants are amount of water available to plants, depth of the root zone, flooding, salinity or sodicity, texture of the surface layer, and wetness. The length of the growing season also is important.

Deciduous trees and woody understory produce bark, buds, catkins, foliage, nuts or other fruit, and twigs that wildlife eat. Examples of deciduous trees and woody understory in the survey area are American elm, birch, boxelder, green ash, maple, oak, poplar, and willow. Examples of fruit-producing shrubs in the survey area are American plum, chokecherry, crabapple, hawthorn, honeysuckle, redosier dogwood, serviceberry, and silver buffaloberry.

Coniferous plants are cone-bearing trees, ground covers, or shrubs that provide habitat or supply food in the form of browse, fruitlike cones, or seed. Examples of coniferous plants in the survey area are cedar, fir, hemlock, juniper, larch, pine, spruce, and yew.

The major soil properties affecting the growth of coniferous and deciduous trees and shrubs are amount of water available to plants, depth of the root zone, and wetness.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Wetland plants produce food or cover for wetland wildlife. Examples of wetland plants in the survey area are arrowhead, bulrush, cattail, millet, pickerelweed, rush, sedge, smartweed, waterplantain, and wildrice.

The major soil properties affecting wetland plants are acidity or alkalinity, slope, texture of the surface layer, and wetness.

Shallow-water areas have an average depth of less than 5 feet. These areas, either naturally wet or created by dams, levees, or water-control measures in marshes or streams, are useful as habitat for some wildlife species. Examples of shallow-water areas in the survey area are beaver ponds and other wildlife ponds, muskrat marshes, waterfowl feeding areas, and wildlife watering developments.

The major soil properties affecting shallow-water areas are depth to bedrock, permeability, slope, surface stoniness, and wetness.

Kinds of Wildlife Habitat

Habitat for openland wildlife consists of cropland, meadows, pasture, and other areas that are overgrown with grasses, herbs, and shrubs. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to openland areas include cottontail rabbit,

field sparrow, Hungarian partridge, killdeer, meadowlark, pheasant, red fox, sage grouse, and sharp-tailed grouse.

Habitat for woodland wildlife consists of areas of coniferous or deciduous trees and shrubs or a mixture of these and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to woodland areas include black bear, deer, elk, owl, porcupine, raccoon, ruffed grouse, thrush, tree squirrel, wild turkey, and woodpecker.

Habitat for wetland wildlife consists of open, marshy or swampy, shallow-water areas that support water-tolerant plants. Wildlife attracted to wetland areas include beaver, bittern, duck, geese, heron, kingfisher, mink, muskrat, otter, and rail.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland areas include antelope, deer, lark bunting, meadowlark, and sage grouse.

Wildlife of the Teton and Pondera County Areas

Habitat quality and interspersion determine wildlife population levels. Suitability of a particular habitat for a wildlife species depends greatly on the nature of the plant communities present. Prevailing land-use practices and management determine the quantity, quality, and distribution of plant communities. These factors are governed to some extent by the soils of the area.

Rating soils for their ability to produce vegetative elements for wildlife habitat does not take into account local climatic influences, present use of soils, juxtaposition of habitat types or elements, or present distribution of wildlife species. For these reasons, the selection and suitability of an area for wildlife habitat development require onsite evaluation.

The survey area provides a variety of wildlife habitats, including footslopes of the Rocky Mountain Front, grassland prairies, irrigated and nonirrigated cropland, limber pine woodland, ponds, reservoirs, riparian shrubland and wetland swamps, rivers, and streams.

Rocky Mountain elk occur as migrants on foothill winter ranges in the extreme western portion of the survey area. Elk spend their summers and falls at relatively high elevations on the Bob Marshall Wilderness, west of the survey area, where moist lush forest types intersperse with grassy mountain meadows. Movement to lower elevations begins in early to late fall, depending upon snowfall. Winter ranges usually consist of grassy windblown ridges or south-facing footslopes along the Rocky Mountain Front.

Both mule deer and white-tailed deer are found throughout the survey area. Mule deer generally occur in the foothill areas in the western part of the survey area where there are brushy bottoms and rough rangeland. White-tailed deer generally inhabit the bottomlands of the Marias, Sun, and Teton Rivers and their tributaries.

Pronghorn antelope inhabit prairie grassland south of the Teton River. Plains, terraces, and uplands provide most of the habitat for pronghorn antelope in the survey area.

In the western part of the survey area, black bear and grizzly bear inhabit the foothills and mountains. Grizzly bear also use the Pine Butte and Blackleaf Swamps. Bears inhabiting these prairie swamps represent the only prairie populations of grizzly bears existing in the United States today.

Bighorn sheep and mountain goats occur in many of the rugged mountains of the Rocky Mountain Front. Bighorn sheep winter ranges include the grassy foothills in the southwestern part of the survey area.

Bottomlands of the major streams and rivers, along with irrigated and nonirrigated cropland, support most of the ring-necked pheasant population. In the survey area, habitat includes brushy thickets, ditchbanks, fence rows, and grain fields.

Hungarian partridge, an introduced game bird from Europe, is associated with cropland and grassland of the survey area. Hungarian partridge, like sharp-tailed grouse, also exhibit population fluctuations. These fluctuations appear to result from changes in available habitat, weather variances, and possibly disease.

Sharp-tailed grouse inhabit the prairie uplands of the area where grain fields and brushy cover, with an abundance of fruit-bearing shrubs, provide excellent habitat. Within these associations, brushy draws; grain fields; shelterbelts; windbreaks; and an intermix of forbs, grasses, and shrubs provide suitable habitat for this prairie species.

Freezeout Lake and the many marshes, ponds, potholes, reservoirs, and rivers scattered throughout the survey area provide habitat for an abundance of waterfowl, including marsh and shore birds, during spring and fall migrations and during the summer production period. Ducks, geese, and a variety of marsh and shore birds use these bodies of water for resting, nesting, and rearing of young.

Beaver, mink, and muskrat occur throughout the principal watercourses. Badger, bobcat, coyote,

ground squirrel, and a variety of small mammals are located throughout the survey area.

Using conservation practices to improve habitat can enhance populations of game and nongame species. These practices include development of odd or irregularly shaped areas in and adjacent to farmland to provide food and cover, protection of habitat from fire or grazing, and establishment of woody vegetation to provide winter shelter. Wildlife habitat may also be enhanced through application of commonly employed conservation practices, including field windbreaks, minimum tillage, planned grazing systems, stripcropping, and pond construction.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. Ratings are based on observed soil performance and on estimated data and test data in the “Soil Properties” section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

Additional interpretations can be made using the information in the tables, along with soil maps, soil descriptions, and other data provided in this survey.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the “Glossary.”

Building Site Development

The “Building Site Development” table shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. Limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, open ditches, utility lines, and other purposes. Ratings are based on soil properties, site features, and observed soil performance. Ease of digging,

filling, and compacting is affected by the depth to bedrock, to a cemented pan, or to a very firm dense layer; stone content; soil texture; and slope. Depth to a seasonal high water table and susceptibility of the soil to flooding affect the time of year that excavations can be made. Soil texture and depth to the water table affect the resistance of the excavation walls or banks to sloughing or caving.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for dwellings without basements, dwellings with basements, and small commercial buildings without basements. Ratings are based on soil properties, site features, and observed soil performance. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills generally are limited to less than 6 feet. Ratings are based on soil properties, site features, and observed soil performance. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, potential for frost action, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. Ratings are based on soil properties, site features, and observed soil performance. Soil reaction; a high water table; depth to bedrock or to a cemented pan; available water capacity in the upper 40 inches; and content of salts, sodium, and sulfidic materials affect plant growth. Flooding; wetness; slope; stoniness; and amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

The “Sanitary Facilities” table shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. This table also shows the suitability of the soils for use as a daily cover for landfill.

Soil properties are important in selecting sites for sanitary facilities and in identifying limiting soil properties and site features to be considered in planning, design, and installation. Soil limitation ratings of *slight, moderate,* or *severe* are given for septic tank absorption fields, sewage lagoons, and trench and area sanitary landfills. Soil suitability ratings of *good, fair,* and *poor* are given for daily cover for landfill.

A rating of *slight* or *good* indicates that the soils have no limitations or that the limitations can be easily overcome. Good performance and low maintenance can be expected. A rating of *moderate* or *fair* indicates that the limitations should be recognized but generally can be overcome by good management or special design. A rating of *severe* or *poor* indicates that overcoming the limitations is difficult or impractical. Increased maintenance may be required.

Septic tank absorption fields are areas in which subsurface systems of tile or perforated pipe distribute effluent from a septic tank into the natural soil. The centerline of the tile is assumed to be at a depth of 24 inches. Only the part of the soil between depths of 24 and 60 inches is considered in making the ratings. Soil properties and site features considered are those that affect the absorption of the effluent, those that affect the construction and maintenance of the system, and those that may affect public health.

Ratings are based on soil properties, site features, and observed soil performance. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock, or a cemented pan, interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a

nearly level floor surrounded by cut slopes or embankments of compacted, relatively impervious soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Relatively impervious soil material for the lagoon floor and sides is desirable to minimize seepage and contamination of local ground water.

The “Sanitary Facilities” table gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. Ratings are based on soil properties, site features, and observed soil performance. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Trench sanitary landfill is an area where solid waste is disposed of by placing refuse in successive layers in an excavated trench. Waste is spread, compacted, and covered daily with a thin layer of soil, excavated from the trench. When the trench is full, a final cover of soil material at least 2-feet thick is placed over the landfill. Soil properties that influence the risk of pollution, the ease of excavation, trafficability, and revegetation are the major considerations in rating the soils.

Area sanitary landfill is an area where solid waste is disposed of by placing refuse in successive layers on the surface of the soil. Waste is spread, compacted, and covered daily with a thin layer of soil that is imported from a source away from the site. A final cover of soil at least 2-feet thick is placed over the completed landfill. Soil properties that influence trafficability, revegetation, and the risk of pollution are the main considerations in rating the soils for area sanitary landfills.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ratings in the “Sanitary Facilities” table are based on soil properties, site features, and observed soil performance. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. Soil material is obtained offsite, transported to the landfill, and spread over the waste. The suitability of a soil for use as cover is based on properties that affect workability and the ease of digging, moving, and spreading the material over the refuse daily during both wet and dry periods.

Soil texture, wetness, rock fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. Soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, the most organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Waste Management

Soil properties are important when organic waste is applied as fertilizer and wastewater is applied in irrigated areas. They are also important when soil is used as a medium for treatment and disposal of organic waste and wastewater. Unfavorable soil properties can result in environmental damage.

Use of organic waste and wastewater as production resources results in energy and resource conservation and minimizes the problems associated with waste disposal. If disposal is the goal, applying a maximum amount of the organic waste or the wastewater to a minimal area holds costs to a minimum and environmental damage is the main hazard. If reuse is the goal, a minimum amount should be applied to a maximum area, then environmental damage is unlikely.

Interpretations developed for waste management may include ratings for manure- and food-processing waste; municipal sewage sludge; use of wastewater

for irrigation; and treatment of wastewater by slow rate, overland flow, and rapid infiltration processes.

Specific information regarding waste management is available from local Natural Resources Conservation Service or Cooperative Extension Service offices.

Construction Materials

The “Construction Materials” table gives information about the soils as a source of roadfill, sand, gravel, and topsoil. Soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In the “Construction Materials” table, soils are rated as a source of roadfill for low embankments, generally less than 6-feet high and less exacting in design than higher embankments.

Ratings are for soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The “Engineering Index Properties” table provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. Soil performance after it is stabilized with lime or cement is not considered in the ratings.

Ratings are based on soil properties, site features, and observed soil performance. Thickness of suitable material is a major consideration. Ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have one or more of the following characteristics: a plasticity index of more than 10, a high shrink-swell potential, many stones, slopes of more than 25 percent, or a water table at a depth of less than 1 foot. They may have layers of suitable material, but it is less than 3-feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In the “Construction Materials” table, only the probability of finding material in suitable quantity in or below the soil is evaluated. Suitability of the material for specific purposes is not evaluated nor are factors that affect excavation of the material.

Properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), thickness of suitable material, and content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the “Engineering Index Properties” table.

A soil rated as a *probable* source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3-feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an *improbable* source. Fragments of soft bedrock, such as shale and siltstone, are not considered sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Reclamation potential of the borrow area is also evaluated.

Toxic material and such properties as soil reaction, available water capacity, and fertility affect plant growth. Slope, the water table, rock fragments, soil texture, and thickness of suitable material affect ease of excavating, loading, and spreading. Slope, the water table, rock fragments, bedrock, and toxic material affect reclamation of the borrow area.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils; loamy soils that have a relatively high content of clay; soils that have only 20 to 40 inches of suitable material; soils that have an appreciable amount of gravel, stones, or soluble salts; or soils that have slopes of 8 to 15 percent. Soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey; have less than 20 inches of suitable material; have a large amount of gravel, stones, or soluble salts; have slopes of more than 15 percent; or have a seasonal high water table at or near the surface.

The surface layer of most soils generally is preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

The “Water Management” table gives information about soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. Limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. Seepage potential is determined by permeability of the soil and depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20-feet high, constructed to impound water or to protect land against overflow. In the “Water Management” table, soils are rated as a source of material for embankment fill. Ratings apply to soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

Ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even more than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material and trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil affect excavated ponds. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving affect excavating and grading and the stability of ditchbanks. Productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. Depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope affect the design and management of an irrigation system. Large stones and depth to bedrock or to a cemented pan affect the construction of a system. Depth of the root zone, the amount of salts or sodium, and soil reaction affect the performance of a system.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. Restricted rooting depth, severe hazard of soil blowing or water erosion, excessively coarse texture,

and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of a soil survey. Data and estimates of soil and water features, listed in the tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

Estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

The “Engineering Index Properties” table gives estimates of the engineering classification and of the range of index properties for major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. Soil series descriptions in Part I of this survey give the range in depth and information on other properties of each layer.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. “Loam,” for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, “gravelly.” Textural terms are defined in the “Glossary.”

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1988) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 based on grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 based on visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments 3 to 10 inches in diameter and larger than 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area, or from nearby areas, and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

The “Physical Properties of the Soils” and “Chemical Properties of the Soils” tables show estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

The following paragraphs describe the columns in the “Physical Properties of the Soils” table.

Depth to the upper and lower boundaries of each layer is indicated. Range in depth and information on other properties of each layer are given in the series descriptions in Part I of this survey.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the largest to the smallest.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. The estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^{1}/_{3}$-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In the “Physical Properties of the Soils” table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. Capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the

change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated based on the kind and amount of clay minerals in the soil and on measurements of similar soils.

Linear extensibility is used to determine the *shrink-swell potential* of soils. The shrink-swell potential is *low* if the soil has a linear extensibility of less than 3 percent, *moderate* if 3 to 6 percent, *high* if 6 to 9 percent, and *very high* if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design is often needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In the "Physical Properties of the Soils" table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. It affects the available water capacity, infiltration rate, and tilth. Organic matter is a source of nitrogen and other nutrients for crops.

Erosion factors are shown in the "Physical Properties of the Soils" table as the K factor (K and Kf) and the T factor. *Erosion factor K* indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor K indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility of soils to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils generally are not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams that have more than 5 percent finely divided calcium carbonate. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils have less than 5 percent finely divided calcium carbonate. They are moderately erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils have less than 5 percent finely divided calcium carbonate. They are moderately erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils have less than 5 percent finely divided calcium carbonate. They are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of rock fragments on the surface or because of surface wetness.

Wind erodibility index is a numerical value indicating the susceptibility of soil to soil blowing, or the tons per acre per year that can be expected to be lost to soil blowing. There is a close correlation between soil blowing and the size and durability of

surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence soil blowing.

The following paragraphs describe the columns in the "Chemical Properties of the Soils" table.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. Soils having a high cation-exchange capacity can retain cations. The ability to retain cations helps to prevent the pollution of ground water.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the soil. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

Gypsum is given as the percent, by weight, of hydrated calcium sulfates in the soil. Gypsum is partially soluble in water and can be dissolved and removed by water. Soils that have a high content of gypsum (more than 10 percent) may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation; it is expressed, in millimhos per centimeter at 25 degrees C, as the electrical conductivity of the saturation extract. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by irrigation water quality and by water application frequency. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of the soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio is the measure of sodium relative to calcium and magnesium in the water extracted from saturated soil paste. Soils having a sodium adsorption ratio of 13 or more may be characterized by increased dispersion of organic matter and clay particles, reduced permeability and aeration, and general degradation of soil structure.

Water Features

The "Water Features" table gives estimates of several important water features used in land-use planning that involves engineering considerations. These features are described in the following paragraphs.

Hydrologic soil groups are groups of soils that, when saturated, have the same runoff potential under similar storm and ground cover conditions. Soil properties affecting the runoff potential are those that influence the minimum rate of infiltration in a bare soil after prolonged wetting and when the soil is not frozen. These properties include depth to a seasonal high water table, intake rate, permeability after prolonged wetting, and depth to a very slowly permeable layer. The influences of ground cover and slope are treated independently and are not taken into account in hydrologic soil groups.

In the definitions of the hydrologic soil groups, the infiltration rate is the rate at which water enters the soil at the surface and is controlled by surface conditions. The transmission rate is the rate at which water moves through the soil and is controlled by properties of the soil layers.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. They consist chiefly of very deep, well-drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. They consist chiefly of moderately deep or deep, moderately well-drained or well-drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. They consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. They consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near

the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflow from streams or by runoff from adjacent slopes. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in marshes and swamps or in closed depressions is considered ponding.

The “Water Features” table gives the frequency and duration of flooding and the time of the year when flooding is most likely to occur. *Frequency*, *duration*, and probable *months* of occurrence are estimated. Frequency generally is expressed as none, rare, occasional, or frequent. *None* means flooding is not probable; *rare* that it is unlikely but is possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year).

Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 to 30 days), and *very long* (more than 30 days). The time of year when flooding is most likely to occur is expressed in *months*. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered is local information about the extent and level of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is a zone of saturation at the highest average depth during the wettest season. It is at least 6-inches thick, persists in the soil for more than a few weeks, and is within 6 feet of the surface. Indicated in the “Water Features” table are *water table depth, kind of water table*, and *months* of the year when the water table usually is highest.

Two numbers in the column, *water table depth*, indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates the water table is above the surface of the soil. > *than 6.0* indicates the water table is below a depth of 6 feet or it is within a depth of 6 feet for less than a month.

An *apparent* water table is indicated by the level at which water stands in a freshly dug, unlined borehole after adequate time is allowed for adjustments in the surrounding soil.

A *perched* water table is one that is above an unsaturated zone in the soil. The basis for determining that a water table is perched may be general knowledge of the area. The water table is proven to be perched if the water level in a borehole is observed to fall when the borehole is extended.

Ponding is standing water in marshes and swamps or in closed depressions. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation.

Soil Features

The “Soil Features” table gives estimates of several important soil features used in land-use planning that involves engineering considerations. These features are described in the following paragraphs.

Depth to bedrock is given if bedrock is within a depth of 60 inches. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

A *cemented pan* is a cemented or indurated subsurface layer within a depth of 5 feet. The particles are held together by cementing substances, such as calcium carbonate and oxides of silicon, iron, or aluminum. Such a pan causes difficulty in excavation. Pans are classified as thin or thick. A thin pan is less than 3-inches thick if continuously indurated or less than 18-inches thick if discontinuous or fractured. Excavations can be made by trenching machines, backhoes, or small rippers. A thick pan is more than 3-inches thick if continuously indurated or more than 18-inches thick if discontinuous or fractured. Such a pan is so thick or massive that blasting or special equipment is needed in excavation.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. It generally results from either desiccation and shrinkage or oxidation of organic material, or both,

following drainage. Subsidence takes place gradually, usually over a period of several years. The “Soil Features” table shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well-drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

A *low* potential for frost action indicates the soil is rarely susceptible to formation of ice lenses; a *moderate* potential indicates the soil is susceptible to formation of ice lenses, resulting in frost heave and subsequent loss of soil strength; and a *high* potential indicates the soil is highly susceptible to formation of ice lenses, resulting in frost heave and subsequent loss of soil strength.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The corrosion rate of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The corrosion rate of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and soil acidity.

Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete in installations that are entirely within one kind of soil or within one soil layer.

For *uncoated steel*, the risk of corrosion, expressed as *low, moderate,* or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For *concrete*, the risk of corrosion, also expressed as *low, moderate,* or *high,* is based on soil texture, acidity, and amount of sulfates in the saturation extract.

References

Alexander, R.R. 1966. Site indexes for lodgepole pine with corrections for stand density; instructions for field use. U.S. Department of Agriculture, Forest Service. Rocky Mountain Forest and Range Experiment Station Research Paper, RP-24.

Alexander, R.R. 1967. Site indexes for Engelmann spruce. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station Research Paper, RP-32.

American Association of State Highway and Transportation Officials (AASHTO). 1986. Standard specifications for highway materials and methods of sampling and testing. 14th edition, 2 volumes.

American Society for Testing and Materials (ASTM). 1988. Standard test method for classification of soils for engineering purposes. ASTM Standard D 2487-00.

Baker, F.S. 1925. Aspen in the Central Rocky Mountain Region. United States Department of Agriculture Bulletin 1291.

Brickell, J.E. 1968. A method for constructing site index curves from measurements of tree age and height—Its application to inland Douglas-fir. U.S. Department of Agriculture, Forest Service, Intermountain Research Station Research Paper INT-RP-47.

Colton, R.B., R.W. Lemke, W. Richard, and R.M. Lindvall. 1961. Glacial map of Montana east of the Rocky Mountains. U.S. Geological Survey geologic map (1:500,000), I-0327.

Dahms, W.G. 1964. Gross and net yield tables for lodgepole pine. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, OR, Research Paper PNW-8.

Gieseker, L.F. 1934. Soils of Pondera County, Soil Reconnaissance of Montana. Preliminary Report. Montana State College, Agricultural Experiment Station. Bulletin No. 291.

Gieseker, L.F. 1937. Soils of Teton County, Soil Reconnaissance of Montana. Preliminary Report. Montana State College, Agricultural Experiment Station. Bulletin No. 332.

Meyer, W.H. 1938. Yield of even-aged stands of ponderosa pine. U.S. Department of Agriculture, Technical Bulletin 630. Washington, DC.

Myers, C.A. 1967. Yield tables for managed stands of lodgepole pine in Colorado and Wyoming. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station Research Paper RM-RP-26.

Noble, R.A., R.N. Bergantino, T.W. Patton, B.C. Sholes, F. Daniel, and J. Scofield. 1982. Occurrence and characteristics of ground water in Montana. Montana Bureau of Mines and Geology Open-File Report 99.

Perry, E.S. 1960. Oil and gas in Montana. Montana Bureau of Mines and Geology Bulletin 15.

Pfister, R.D., B.L. Kovalchik, S.F. Arno, and R.C. Presby. 1977. Forest habitat types of Montana. U.S. Department of Agriculture, Forest Service, Intermountain Research Station General Technical Report INT-GTR-34.

Sauerwein, W.J. 1979. Site index for black cottonwood. Compiled from British Columbia Forest Service data. U.S. Department of Agriculture, Soil Conservation Service, Western Region.

Soil Survey Division Staff. 1962. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. (http://soils.usda.gov/technical/manual/)

Soil Survey Staff. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436. (http://soils.usda.gov/technical/classification/taxonomy/)

Soil Survey Staff. 1987. Keys to soil taxonomy. 3rd edition. U.S. Department of Agriculture, Natural Resources Conservation Service. (http://soils.usda.gov/technical/classification/tax_keys/)

United States Department of Agriculture, Natural Resources Conservation Service. Montana Field Office Technical Guide, Section II. (http://www.nrcs.usda.gov/technical/efotg/)

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

United States Department of Agriculture, Soil Conservation Service. 1976. National range handbook. (http://www.glti.nrcs.usda.gov/technical/publications/nrph.html)

United States Department of Agriculture, Soil Conservation Service, and United States Department of the Interior, Bureau of Indian Affairs. 1980. Soil Survey of Glacier County Area and part of Pondera County, Montana.

Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. (See Sodic (alkali) soil.)

Alluvial fan. A body of alluvium, with overflow of water and debris flow deposits, whose surface forms a segment of a cone that radiates downslope from the point where the stream emerges from a narrow valley onto a less sloping surface. Source uplands range in relief and areal extent from mountains to gullied terrains on hillslopes.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redox feature.

Animal-unit-month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redox features.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillite. Weakly metamorphosed mudstone or shale.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3.75
Low	3.75 to 5.0
Moderate	5.0 to 7.5
High	more than 7.5

Avalanche chute. The track or path formed by an avalanche.

Backslope. The geomorphic component that forms the steepest inclined surface and principal element of many hillslopes. Backslopes in profile are commonly steep and linear and descend to a footslope. In terms of gradational process, backslopes are erosional forms produced mainly by mass wasting and running water.

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope. A geomorphic component of hills consisting of the concave to linear (perpendicular

to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Bedding planes. Fine strata, less than 5-millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-floored plain. An extensive nearly level to gently rolling or moderately sloping area that is underlain by hard bedrock and has a slope of 0 to 8 percent.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of cobbles or gravel. In some blowouts, the water table is exposed.

Board foot. A unit of measure of the wood in lumber, logs, or trees. The amount of wood in a board 1 foot wide, 1 foot long, and 1 inch thick before finishing.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Bouldery. Refers to a soil with .01 to 0.1 percent of the surface covered with boulders.

Bouldery soil material. Soil that is 15 to 35 percent, by volume, rock fragments that are dominated by fragments larger than 24 inches (60 centimeters) in diameter.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management. Use of mechanical, chemical, or biological methods to reduce or eliminate competition from woody vegetation and thus to allow understory grasses and forbs to recover or to make conditions favorable for reseeding. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds directly beneath the solum, or it is exposed at the surface by erosion.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channeled. Refers to a drainage area in which natural meandering or repeated branching and convergence of a streambed have created deeply incised cuts, either active or abandoned, in alluvial material.

Channery soil material. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Cirque. A semicircular, concave, bowl-like area that has steep faces primarily resulting from erosive activity of a mountain glacier.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clayey soil. Silty clay, sandy clay, or clay.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Clearcut. A method of forest harvesting that removes the entire stand of trees in one cutting. Reproduction is achieved artificially or by natural seeding from the adjacent stands.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Closed depression. A low area completely surrounded by higher ground and having no natural outlet.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

Codominant trees. Trees whose crowns form the general level of the forest canopy and that receive full light from above but comparatively little from the sides.

COLE (coefficient of linear extensibility). (See Linear extensibility.)

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Commercial forest. Forestland capable of producing 20 cubic feet or more per acre per year at the culmination of mean annual increment.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conglomerate. A coarse-grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer-textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. Any tillage and planting system in which a cover of crop residue is maintained on at least 30 percent of the soil surface after planting in order to reduce the hazard of water erosion. In areas where soil blowing is the primary concern, a system that maintains a cover of at least 1,000 pounds of flat residue of small grain or the equivalent during the critical erosion period.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to

compression. Terms describing consistence are defined in the "Soil Survey Manual" (Soil Survey Division Staff, 1962).

Consolidated sandstone. Sandstone that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry, are not easily crushed, and cannot be textured by the usual field method.

Consolidated shale. Shale that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry and are not easily crushed.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deep soil. A soil that is 40 to 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Dominant trees. Trees whose crowns form the general level of the forest canopy and that receive full light from above and from the sides.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown, and yields are low.

Well drained.—These soils have an intermediate water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless a drainage system is installed. Moderately well-drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless a drainage system is installed. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet, at or near the surface, during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except rice) unless a drainage system is installed.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainageway. An area of ground at a lower elevation than the surrounding ground and in which water collects and is drained to a closed depression or lake or to a drainageway at a lower elevation. A drainageway may or may not have distinctly incised channels at its upper reaches or throughout its course.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Dune. A mound, ridge, or hill of loose, windblown granular material (generally sand), either bare or covered with vegetation.

Ecological site. An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Esker. A long, narrow, sinuous, steep-sided ridge composed of irregularly stratified sand and gravel that were deposited by a subsurface stream flowing between ice walls or through ice tunnels of a retreating glacier and that were left behind when the ice melted. Eskers range from less than a mile to more than 100 miles in length and from 10 to 100 feet in height.

Even aged. Refers to a stand of trees in which only small differences in age occur between individual trees. A range of 20 years is allowed.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess salt (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well-preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. Area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (300 meters) and fringes a mountain range or high-plateau escarpment.

Footslope. The geomorphic component that forms the inner, gently inclined surface at the base of a hillslope. The surface profile is dominantly concave. In terms of gradational processes, a footslope is a transitional zone between an upslope site of erosion (backslope) and a downslope site of deposition (toeslope).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Giant ripple mark. The undulating surface sculpture produced in noncoherent granular materials by currents of water and by the agitation of water in

wave action during the draining of large glacial lakes, such as Glacial Lake Missoula.

Glacial drift. Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciated uplands. Land areas that were previously covered by continental or alpine glaciers and that are at a higher elevation than the flood plain.

Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Soil that is 15 to 35 percent, by volume, rounded or angular rock fragments up to 3 inches (7.6 centimeters) in diameter. Very gravelly soil is 35 to 60 percent gravel, and extremely gravelly soil is more than 60 percent gravel by volume.

Grazeable forestland. Land capable of sustaining livestock grazing by producing forage of sufficient quantity during one or more stages of secondary forest succession.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Gypsum. A mineral consisting of hydrous calcium sulfate.

Habitat type. An aggregation of all land areas capable of producing similar climax plant communities.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head out. To form a flower head.

Heavy metal. Inorganic substances that are solid at ordinary temperatures and are not soluble in water. They form oxides and hydroxides that are basic. Examples are copper, iron, cadmium, zinc, manganese, lead, and arsenic.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well-defined outline; hillsides generally have slopes of more than 8 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the “Soil Survey Manual” (Soil Survey Division Staff, 1962). The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A or E horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Sedimentary beds of consolidated sandstone and semiconsolidated and consolidated shale. Generally, roots can penetrate this horizon only along fracture planes.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame. A moundlike hill of glacial drift, composed chiefly of stratified sand and gravel.

Kame terrace. A terracelike ridge consisting of stratified sand and gravel that were deposited by a meltwater stream flowing between a melting glacier and a higher valley wall or lateral moraine and that remained after the disappearance of the ice. It is commonly pitted with kettles and has an irregular ice-contact slope.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain. A surface marking the floor of an extinct lake, filled in by well-sorted, stratified sediments.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Lateral moraine. A ridgelike moraine carried on and deposited at the side margin of a valley glacier. It is composed chiefly of rock fragments derived from the valley walls by glacial abrasion and plucking or by mass wasting.

Leaching. The removal of soluble material from soil or other material by percolating water.

Linear extensibility. Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $1/_{3}$- or $1/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loamy soil. Coarse sandy loam, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, silt, clay loam, sandy clay loam, or silty clay loam.

Loess. Fine-grained material, dominantly of silt-sized particles, deposited by wind.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redox concentration.

Mean annual increment (MAI). The average annual increase in volume of a tree during its entire life.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Merchantable trees. Trees that are of sufficient size to be economically processed into wood products.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Microhigh. An area that is 2 to 12 inches higher than the adjacent microlow.

Microlow. An area that is 2 to 12 inches lower than the adjacent microhigh.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Miscellaneous water. A sewage lagoon, an industrial waste pit, a fish hatchery, or a similar water area.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately deep soil. A soil that is 20 to 40 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine. An accumulation of glacial drift in a topographic landform of its own, resulting chiefly from the direct action of glacial ice. Some types are lateral, recessional, and terminal.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Areas of color that differ from the matrix color. These colors are commonly attributes retained from the geologic parent material. (See Redox features for indications of poor aeration and impeded drainage.)

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Muck. Dark, finely divided, well-decomposed organic soil material. (See Sapric soil material.)

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Naturalized pasture. Forestland that is used primarily for the production of forage for grazing by livestock rather than for the production of wood products. Overstory trees are removed or managed to promote the native and introduced understory vegetation occurring on the site. This vegetation is managed for its forage value through the use of grazing management principles.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Observed rooting depth. Depth to which roots have been observed to penetrate.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Outwash plain. An extensive area of glaciofluvial material that was deposited by meltwater streams.

Overstory. The trees in a forest that form the upper crown cover.

Oxbow. The horseshoe-shaped channel of a former meander, remaining after the stream formed a cutoff across a narrow meander neck.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots.

For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water or air to move downward through the profile.

Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit. The range of moisture content within which the soil remains plastic.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse-grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential natural community (PNC). The biotic community that would become established on an ecological site if all successional sequences were completed without interferences by man under the present environmental conditions. Natural disturbances are inherent in its development. The PNC may include acclimatized or naturalized nonnative species.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. The application of fire to land under such conditions of weather, soil moisture, and time of day as presumably will result in the intensity of heat and spread required to accomplish specific forest management, wildlife, grazing, or fire hazard reduction purposes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Quartzite, metamorphic. Rock consisting mainly of quartz that formed through recrystallization of quartz-rich sandstone or chert.

Quartzite, sedimentary. Very hard but unmetamorphosed sandstone consisting chiefly of quartz grains.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. (See Similarity index.)

Range site. (See Ecological site.)

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Recessional moraine. A moraine formed during a temporary but significant halt in the retreat of a glacier.

Red beds. Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Redox concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redox depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redox features. Redox concentrations, redox depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redox feature.

Regeneration. The new growth of a natural plant community, developing from seed.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relict stream terrace. One of a series of platforms in or adjacent to a stream valley that formed prior to the current stream system.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Riser. The relatively short, steeply sloping area below a terrace tread that grades to a lower terrace tread or base level.

Riverwash. Unstable areas of sandy, silty, clayey, or gravelly sediments. These areas are flooded, washed, and reworked by rivers so frequently that they support little or no vegetation.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, boulders, stones, cobbles, and gravel.

Rock outcrop. Exposures of bare bedrock other than lava flows and rock-lined pits.

Root zone. The part of the soil that can be penetrated by plant roots.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Rubble land. Areas that have more than 90 percent of the surface covered by stones or boulders. Voids contain no soil material and virtually no vegetation other than lichens. The areas commonly are at the base of mountain slopes, but some are on mountain slopes as deposits of cobbles, stones, and boulders left by Pleistocene glaciation or by periglacial phenomena.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the

soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salinity. The electrical conductivity of a saline soil. It is expressed, in millimhos per centimeter, as follows:

Nonsaline	0 to 4
Slightly saline	4 to 8
Moderately saline	8 to 16
Strongly saline	more than 16

Salty water (in tables). Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sandy soil. Sand or loamy sand.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Sawlogs. Logs of suitable size and quality for the production of lumber.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Scribner's log rule. A method of estimating the number of board feet that can be cut from a log of a given diameter and length.

Sedimentary plain. An extensive nearly level to gently rolling or moderately sloping area that is underlain by sedimentary bedrock and that has a slope of 0 to 8 percent.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Sedimentary uplands. Land areas of bedrock formed from water- or wind-deposited sediments. They are higher on the landscape than the flood plain.

Seepage (in tables). The movement of water through soil. Seepage adversely affects the specified use.

Semiconsolidated sedimentary beds. Soft geologic sediments that disperse when fragments are placed in water. The fragments are hard or very hard when dry. Determining the texture by the usual field method is difficult.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shallow soil. A soil that is 10 to 20 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shelterwood system. A forest management system requiring the removal of a stand in a series of cuts so that regeneration occurs under a partial canopy. After regeneration, a final cut removes the shelterwood and allows the stand to develop in the open as an even-aged stand. The system is well suited to sites where shelter is needed for regeneration, and it can aid regeneration of the more intolerant tree species in a stand.

Shoulder. The uppermost inclined surface at the top of a hillside. It is the transitional zone from the backslope to the summit of a hill or mountain. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope. A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeters) to the lower limit of very fine sand (0.05 millimeters). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Similarity index. A similarity index is the percentage of a specific vegetation state plant community that is presently on the site.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site class. A grouping of site indexes into five to seven production capability levels. Each level can be represented by a site curve.

Site curve (50-year). A set of related curves on a graph that shows the average height of dominant or dominant and codominant trees for the range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant or dominant and codominant trees that are 50 years old or are 50 years old at breast height.

Site curve (100-year). A set of related curves on a graph that shows the average height of dominant or dominant and codominant trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant or dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant or dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Skid trails. Pathways along which logs are dragged to a common site for loading onto a logging truck.

Slash. The branches, bark, treetops, reject logs, and broken or uprooted trees left on the ground after logging.

Slickens. Accumulations of fine textured material, such as material separated in placer-mine and ore-mill operations. Slickens from ore mills commonly consist of freshly ground rock that has undergone chemical treatment during the milling process.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slickspot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is loamy or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the following slope classes are recognized:

Nearly level	0 to 2 percent
Gently sloping	2 to 4 percent
Moderately sloping	4 to 8 percent
Strongly sloping	8 to 15 percent
Moderately steep	15 to 25 percent
Steep	25 to 45 percent
Very steep	more than 45 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to Ca^{++} + Mg^{++}. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Species. A single, distinct kind of plant or animal having certain distinguishing characteristics.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with tillage, or stones cover .01 to 0.1 percent of the surface. Very stony means that 0.1 to 3.0 percent of the surface is covered with stones. Extremely stony means that 3 to 15 percent of the surface is covered with stones.

Stony soil material. Soil that is 15 to 35 percent, by volume, rock fragments that are dominated by fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Strath terrace. A surface cut formed by the erosion of hard or semiconsolidated bedrock and thinly mantled with stream deposits.

Stream channel. The hollow bed where a natural stream of surface water flows or may flow; the deepest or central part of the bed, formed by the main current and covered more or less continuously by water.

Stream terrace. One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel. It originally formed near the level of the stream and is the dissected remnants of an abandoned flood plain, streambed, or valley floor that were produced during a former stage of erosion or deposition.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter or loosen a layer that is restrictive to roots.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to

produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit. A general term for the top, or highest level, of an upland feature, such as a hill or mountain. It commonly refers to a higher area that has a gentle slope and is flanked by steeper slopes.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Tailwater. The water directly downstream of a structure.

Talus. Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Terracette. Small, irregular step-like forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may or may not be induced by trampling of livestock such as sheep or cattle.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). A layer of otherwise suitable soil material that is too thin for the specified use.

Till plain. An extensive, nearly level to gently rolling or moderately sloping area that is underlain by or consists of till and that has a slope of 0 to 8 percent.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The outermost inclined surface at the base of a hill. Toeslopes are commonly gentle and linear in profile.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Trafficability. The degree to which a soil is capable of supporting vehicular traffic across a wide range in soil moisture conditions.

Tread. The relatively flat terrace surface that was cut or built by stream or wave action.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Understory. Any plants in a forest community that grow to a height of less than 5 feet.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley. An elongated depressional area primarily developed by stream action.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Very deep soil. A soil that is more than 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Very shallow soil. A soil that is less than 10 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Water-spreading. Diverting runoff from natural channels by means of a system of dams, dikes, or ditches and spreading it over relatively flat surfaces.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse-grained particles that are well distributed over wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

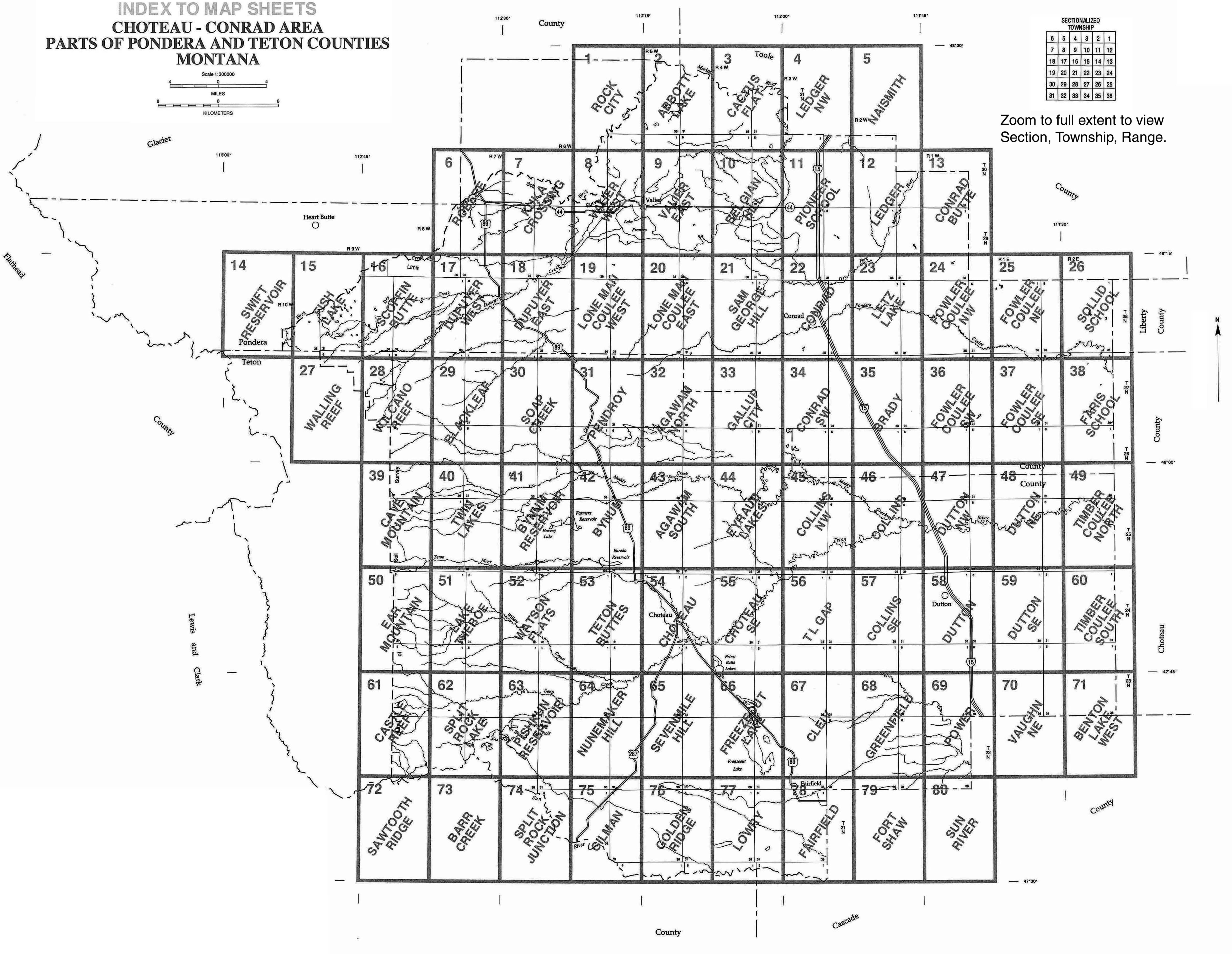
Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The action of uprooting and tipping over trees by the wind.

Accessibility Statement

The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

INDEX TO MAP SHEETS
CHOTEAU - CONRAD AREA
PARTS OF PONDERA AND TETON COUNTIES
MONTANA



SOIL LEGEND

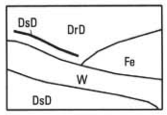
The publication symbols consist of field symbols. Symbols consist of numbers or a combination of numbers and letters, for example, 18A, 266D, 2, and 1823F. For the symbols designated by a number and a letter, the number designates the soil type and the letter designates the slope class. The symbols without a number designate a miscellaneous area. Map units are arranged numerically by field symbols.

SYMBOL	NAME
3B	Lardell silty clay loam, 0 to 4 percent slopes
7A	Havre loam, 0 to 2 percent slopes, rarely flooded
15B	Crago gravelly loam, 0 to 4 percent slopes
15C	Crago gravelly loam, 4 to 8 percent slopes
20B	Judith loam, 0 to 4 percent slopes
22B	Kremlin loam, 0 to 4 percent slopes
23B	Rothiemay clay loam, 0 to 4 percent slopes
29B	Windham gravelly loam, 0 to 4 percent slopes
29C	Windham gravelly loam, 4 to 8 percent slopes
31B	Acel silty clay loam, 0 to 4 percent slopes
34C	Chinook fine sandy loam, 0 to 8 percent slopes
38A	McKenzie clay, 0 to 2 percent slopes
39B	Ethridge silty clay loam, 0 to 4 percent slopes
40B	Kobase silty clay loam, 0 to 4 percent slopes
40C	Kobase silty clay loam, 4 to 8 percent slopes
41B	Richey silty clay loam, 0 to 4 percent slopes
42C	Yetull loamy fine sand, 0 to 15 percent slopes
44B	Marias silty clay, 0 to 4 percent slopes
45B	Marvan clay, 0 to 4 percent slopes
46	Denied access
46A	Pendroy clay, 0 to 2 percent slopes
50B	Marias-Nunemaker complex, 0 to 4 percent slopes
52A	Nishon silt loam, 0 to 2 percent slopes
53B	Evanston loam, 0 to 4 percent slopes
55A	Tetonview loam, 0 to 2 percent slopes
56A	Truchot clay loam, 0 to 2 percent slopes
58B	Floweree silt loam, 0 to 4 percent slopes
61F	Hillon clay loam, 15 to 60 percent slopes
68A	Saypo clay loam, 0 to 2 percent slopes, rarely flooded
70B	Megonot silty clay loam, 0 to 4 percent slopes
80B	Pylon silty clay loam, 0 to 4 percent slopes
82B	Tanna clay loam, 0 to 4 percent slopes
102A	Winginaw-Birchfield mucky peats, 0 to 2 percent slopes
107A	Havre-Ryell loams, 0 to 2 percent slopes, rarely flooded
108A	Korchea-Ridgelawn loams, 0 to 2 percent slopes, rarely flooded
109B	Nesda, occasionally flooded-Riverwash complex, 0 to 4 percent slopes
110B	Rivra, occasionally flooded-Riverwash complex, 0 to 4 percent slopes
111A	Ryell-Rivra complex, 0 to 2 percent slopes, occasionally flooded
114A	Gerdrum-Absher clay loams, 0 to 2 percent slopes
115B	Niart-Crago-Arrod gravelly loams, 0 to 4 percent slopes
116B	Attewan fine sandy loam, 0 to 4 percent slopes
117B	Kiev-Fairfield complex, 0 to 4 percent slopes
118B	Binna-Scravo complex, 0 to 4 percent slopes
119A	Tetonview-Birchfield complex, 0 to 2 percent slopes
120B	Judith-Kiev loams, 0 to 4 percent slopes
120C	Judith-Kiev loams, 4 to 8 percent slopes
121B	Kiev-Judith gravelly loams, 0 to 4 percent slopes
123B	Rothiemay-Niart clay loams, 0 to 4 percent slopes
124B	Varney-Rothiemay clay loams, 0 to 4 percent slopes
125A	Fairway-Meadowcreek loams, 0 to 2 percent slopes, rarely flooded
126B	Shawmut-Windham gravelly loams, 0 to 4 percent slopes
128B	Utica-Windham very gravelly loams, 0 to 4 percent slopes
131B	Creed-Gerdrum complex, 0 to 4 percent slopes
132C	Assinniboine fine sandy loam, 0 to 8 percent slopes
137B	Creed-Absher complex, 0 to 4 percent slopes
145A	Marvan, wet-Nobe silty clays, 0 to 2 percent slopes
147C	Linnet-Abor silty clays, 2 to 8 percent slopes
148C	Megonot-Richey-Tanna clay loams, 2 to 8 percent slopes
150B	Marias-Linnet silty clays, 0 to 4 percent slopes
151C	Yamacall-Delpoint loams, 2 to 8 percent slopes
151D	Yamacall-Delpoint, loams, 8 to 15 percent slopes
156A	Truchot-Saypo clay loams, 0 to 2 percent slopes, rarely flooded
158C	Lonna-Floweree silt loams, 2 to 8 percent slopes
160A	Vanda-Marvan clays, 0 to 2 percent slopes
161F	Hillon-Yawdim complex, 15 to 45 percent slopes
162C	Telstad-Joplin loams, 4 to 8 percent slopes
163C	Kevin-Hillon clay loams, 2 to 8 percent slopes
163D	Hillon-Kevin clay loams, 8 to 15 percent slopes
164B	Scobey-Kevin clay loams, 0 to 4 percent slopes
165B	Telstad-Joplin loams, 0 to 4 percent slopes
168A	Saypo-Truchot clay loams, 0 to 2 percent slopes, rarely flooded
169C	Bascovy-Neldore complex, 2 to 8 percent slopes
170C	Abor-Yawdim silty clay loams, 4 to 15 percent slopes
170E	Abor-Yawdim silty clay loams, 15 to 35 percent slopes
173E	Cabbart-Delpoint loams, 15 to 35 percent slopes
174D	Amor-Cabba loams, 2 to 15 percent slopes
174E	Cabba-Amor loams, 15 to 35 percent slopes
176C	Delpoint-Cabbart loams, 2 to 15 percent slopes
177C	Rootel-Marmarth loams, 2 to 8 percent slopes
179C	Linwell-Winifred clay loams, 2 to 15 percent slopes
181E	Twilight-Yetull-Rock outcrop complex, 8 to 25 percent slopes
184D	Kiev-Roundor loams, 2 to 15 percent slopes
187F	Wayden-Cabba-Winifred complex, 15 to 45 percent slopes
189E	Yawdim-Delpoint-Rock outcrop complex, 8 to 35 percent slopes
191F	Whitore-Starley stony loams, 15 to 45 percent slopes
193E	Loberg-Whitore-Garlet stony loams, 8 to 35 percent slopes
194E	Bynum-Adel-Doby complex, 4 to 35 percent slopes
195B	Hanson-Raynesford complex, 0 to 4 percent slopes
196E	Teton-Tibson-Cheadle complex, 4 to 35 percent slopes
197E	Adel-Doby-Hanson complex, 8 to 35 percent slopes
198C	Adel-Gallatin-Shedhorn complex, 0 to 8 percent slopes
202A	Winginaw-Dougcliff mucky peats, 0 to 2 percent slopes
207A	Ryell-Havre loams, 0 to 2 percent slopes, occasionally flooded
208A	Korchea-Straw loams, 0 to 2 percent slopes, rarely flooded
211A	Ryell-Rivra complex, 0 to 2 percent slopes, rarely flooded
214A	Absher clay loam, wet, 0 to 2 percent slopes
216C	Attewan-Wabek complex, 0 to 8 percent slopes
218B	Scravo gravelly loam, 0 to 4 percent slopes
220B	Judith-Windham complex, 0 to 4 percent slopes
220C	Judith-Windham complex, 4 to 8 percent slopes
222B	Trudau loam, 0 to 4 percent slopes
223D	Rothiemay-Crago complex, 4 to 15 percent slopes
224B	Varney-Rothiemay gravelly clay loams, 0 to 4 percent slopes
230B	Niart-Crago gravelly loams, 0 to 4 percent slopes
230C	Niart-Crago gravelly loams, 4 to 8 percent slopes
240B	Kobase-Marias complex, 0 to 4 percent slopes
241A	Marcott silty clay loam, 0 to 2 percent slopes
249D	Lothair-Marias complex, 4 to 15 percent slopes
250B	Nunemaker silty clay loam, 0 to 4 percent slopes
250C	Nunemaker silty clay loam, 4 to 8 percent slopes
257E	Hillon-Lambeth complex, 15 to 35 percent slopes
263C	Scobey-Kevin clay loams, 4 to 8 percent slopes
264B	Scobey-Acel complex, 0 to 4 percent slopes
268A	Saypo-Tetonview complex, 0 to 2 percent slopes, rarely flooded
270C	Megonot-Tanna clay loams, 2 to 8 percent slopes
271F	Cabba-Castner-Rock outcrop complex, 25 to 60 percent slopes
273F	Cabbart-Delpoint-Rock outcrop complex, 25 to 70 percent slopes
277B	Rootel-Rentsac complex, 0 to 4 percent slopes
281C	Twilight-Chinook-Yetull complex, 2 to 8 percent slopes
284D	Kiev-Roundor gravelly loams, 2 to 15 percent slopes
285C	Winifred-Wayden-Cabba complex, 2 to 15 percent slopes
286F	Neldore-Bascovy-Rock outcrop complex, 25 to 60 percent slopes
291F	Starley-Rock outcrop-Rubble land complex, 25 to 70 percent slopes
294E	Adel-Burnette-Bynum complex, 4 to 35 percent slopes
296E	Babb-Tibson-Adel complex, 4 to 35 percent slopes
308A	Ridgelawn-Nesda-Korchea complex, 0 to 2 percent slopes, occasionally flooded
322B	Kremlin clay loam, 0 to 4 percent slopes
322C	Kremlin clay loam, 4 to 8 percent slopes
327C	Beanlake-Winspect cobbly loams, 2 to 15 percent slopes
327E	Winspect-Beanlake cobbly loams, 15 to 35 percent slopes
330B	Niart gravelly loam, 0 to 4 percent slopes
334C	Chinook-Joplin complex, 2 to 8 percent slopes
356A	Truchot-Tetonview-Saypo complex, 0 to 2 percent slopes, rarely flooded
364D	Scobey-Hillon clay loams, 2 to 15 percent slopes
367F	Megonot-Yawdim-Crago complex, 15 to 60 percent slopes
368A	Saypo clay loam, saline, 0 to 2 percent slopes, rarely flooded
376F	Delpoint-Cabbart-Hillon complex, 25 to 60 percent slopes
377C	Marmarth-Delpoint-Cabbart complex, 2 to 8 percent slopes
381C	Twilight-Rentsac complex, 2 to 8 percent slopes
384C	Shambo-Amor loams, 2 to 8 percent slopes
384D	Shambo-Amor loams, 8 to 15 percent slopes
390F	Cheadle-Doby-Rock outcrop complex, 15 to 60 percent slopes
394E	Adel-Burnette-Sebud complex, 4 to 35 percent slopes
400	Havre-Fairway loams, 0 to 4 percent slopes, rarely flooded
403	Haploborolls-Argiborolls complex, 0 to 4 percent slopes, rarely flooded
406	Harlake clay loam, 0 to 4 percent slopes, rarely flooded
427C	Beanlake-Saypo-Winspect complex, 0 to 8 percent slopes
434B	Chinook-Kremlin complex, 0 to 4 percent slopes
439B	Ethridge clay loam, 0 to 4 percent slopes
458B	Floweree silty clay loam, 0 to 4 percent slopes
468A	Saypo-Tetonview complex, saline, 0 to 2 percent slopes, rarely flooded
474F	Cabba-Roundor-Windham complex, 25 to 60 percent slopes
475F	Kiev-Roundor-Windham complex, 15 to 45 percent slopes
476D	Delpoint-Kremlin-Cabbart complex, 4 to 15 percent slopes
477C	Marmarth-Evanston-Delpoint complex, 2 to 15 percent slopes
486F	Neldore-Lambeth-Rock outcrop complex, 35 to 70 percent slopes
493E	Garlet-Cheadle-Loberg stony loams, 8 to 45 percent slopes
495B	Hanson very cobbly loam, 0 to 4 percent slopes
500	Riverwash
522C	Kremlin-Delpoint clay loams, 2 to 8 percent slopes
523B	Rothiemay gravelly clay loam, 0 to 4 percent slopes
523C	Rothiemay gravelly clay loam, 4 to 8 percent slopes
527E	Beanlake-Cabba-Castner complex, 8 to 35 percent slopes
534D	Chinook-Twilight fine sandy loams, 2 to 15 percent slopes
539B	Ethridge-Nunemaker silty clay loams, 0 to 4 percent slopes
540B	Marvan silty clay, wet, 0 to 4 percent slopes
541C	Kobase-Ethridge clay loams, 4 to 8 percent slopes
550C	Nunemaker-Marias complex, 4 to 8 percent slopes
570D	Megonot-Kobase-Yawdim complex, 8 to 15 percent slopes
574E	Cabba-Wayden-Castner complex, 4 to 35 percent slopes
576F	Delpoint-Cabbart-Crago complex, 15 to 60 percent slopes
589F	Megonot-Yawdim-Rock outcrop complex, 25 to 60 percent slopes
590E	Babb-Fifer-Cheadle complex, 8 to 45 percent slopes
596E	Whitore-Babb-Tibson complex, 8 to 45 percent slopes
620C	Judith-Windham cobbly loams, 0 to 8 percent slopes
623C	Rothiemay-Delpoint gravelly clay loams, 2 to 8 percent slopes
623D	Rothiemay-Delpoint gravelly clay loams, 8 to 15 percent slopes
630B	Rothiemay, calcareous-Niart gravelly clay loams, 0 to 4 percent slopes
630C	Rothiemay-Niart gravelly clay loams, 4 to 8 percent slopes
650C	Nunemaker-Ethridge silty clay loams, 4 to 8 percent slopes
676C	Delpoint-Rothiemay clay loams, 2 to 8 percent slopes
676D	Delpoint-Rothiemay clay loams, 8 to 15 percent slopes
693F	Whitore-Garlet-Starley stony loams, 15 to 60 percent slopes
696E	Whitore-Teton-Tibson complex, 8 to 35 percent slopes
700	Urban land
722C	Marvan, wet-Trudau complex, 0 to 8 percent slopes
723B	Rothiemay-Niart gravelly clay loams, 0 to 4 percent slopes
727C	Beanlake-Manhattan-Winspect complex, 2 to 15 percent slopes
776C	Delpoint-Cabbart-Rootel loams, 2 to 15 percent slopes
784C	Kiev-Winifred-Vanda complex, 0 to 15 percent slopes
800	Pits, gravel
823A	Saypo clay loam, sodic, 0 to 2 percent slopes, rarely flooded
876C	Delpoint-Kremlin-Vanda complex, 2 to 15 percent slopes
904F	Cheadle-Adel-Doby complex, 15 to 60 percent slopes
923B	Saypo-Niart clay loams, 0 to 4 percent slopes
M-W	Miscellaneous water
W	Water

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

SOIL SURVEY FEATURES

SOIL DELINEATIONS AND SYMBOLS



Blowout

Borrow pit

Clay spot

Depression, closed

Escarpment, bedrock

Escarpment, nonbedrock

Gravel pit

Gravelly spot

Gully

Levee

Marsh or swamp

Mine or quarry

Perennial water

Rock outcrop

Saline spot

Sandy spot

Short steep slope

Slide or slip

Sodic spot

Spoil area

Stony spot

Very stony spot

Wet spot

AD HOC FEATURES

Calcareous area

Seep area

CULTURAL FEATURES

BOUNDARIES

County or parish

Reservation (national or state forest or park)

Limit of soil survey (label)

Map sheet neatline

Public land survey system section boundary

ROAD EMBLEMS & DESIGNATIONS

Interstate

Federal

State

Symbol Definitions

LABEL	NAME	DESCRIPTION
	Blowout	A small saucer-, cup-, or trough-shaped hollow or depression formed by wind erosion on a preexisting sand deposit. Typically less than 5 acres.
	Borrow pit	An open excavation from which soil and underlying material have been removed, usually for construction purposes. Typically less than 5 acres.
	Calcareous area	A soil surface layer containing sufficient free calcium carbonate or calcium-magnesium carbonate to effervesce visibly when treated with cold 0.1N hydrochloric acid. Typically less than 5 acres.
	Clay spot	A spot where the surface texture is silty clay or clay in areas where the surface layer is sandy loam, loam, silt loam, or coarser. Typically less than 5 acres.
	Depression, closed	A shallow, saucer-shaped area that is slightly lower on the landscape than the surrounding area and is without a natural outlet for surface drainage. Typically less than 5 acres.
	Escarpment, bedrock	A relatively continuous and steep slope or cliff, which was produced by erosion or faulting, that breaks the general continuity of more gently sloping land surfaces. Exposed material is hard or soft bedrock.
	Escarpment, nonbedrock	A relatively continuous and steep slope or cliff, which generally is produced by erosion but can be produced by faulting, that breaks the continuity of more gently sloping land surfaces. Exposed earthy material is nonsoil or very shallow soil.
	Gravel pit	An open excavation from which soil and underlying material have been removed and used, without crushing, as a source of sand or gravel. Typically less than 5 acres.
	Gravelly spot	A spot where the surface layer has more than 35 percent, by volume, rock fragments that are mostly less than 3 inches in diameter in an area of surrounding soil with less than 15 percent fragments. Typically less than 5 acres.
	Gully	A small channel with steep sides cut by running water through which water ordinarily runs only after a rain or after ice or snow melts. It generally is an obstacle to wheeled vehicles and is too deep to be obliterated by ordinary tillage.
	Levee	An embankment that confines or controls water, especially one built along the banks of a river to prevent overflow of lowlands.
	Marsh or swamp	A water-saturated, very poorly drained area, intermittently or permanently covered by water. Sedges, cattails, and rushes dominate marsh areas. Trees or shrubs dominate swamps. Not used in map units where the named components are poorly drained or very poorly drained. Typically less than 5 acres.
	Mine or quarry	An open excavation from which soil and underlying material are removed, exposing the bedrock. Also used to denote surface openings to underground mines. Typically less than 5 acres.
	Perennial water	Small, natural or constructed lake, pond, or pit that contains water most of the year. Typically less than 5 acres.
	Rock outcrop	An exposure of bedrock at the surface of the earth. Not used where the named soils of the surrounding map unit are shallow over bedrock or where "Rock outcrop" is a named component of the map unit. Typically less than 5 acres.
	Saline spot	An area where the surface layer has an electrical conductivity (EC) of 8 mmhos cm-1 more than the surface layer of the named soils in the surrounding map unit, which have an EC of 2 mmhos cm-1 or less. Typically less than 5 acres.
	Sandy spot	A spot where the surface layer is loamy fine sand or coarser in areas where the surface layer of the named soils of the surrounding map unit is very fine sandy loam or finer. Typically less than 5 acres.
	Seep area	A generally small area where water percolates slowly to the land surface. Typically less than 5 acres.
	Short, steep slope	Narrow soil area that has slopes that are at least two slope classes steeper than the slope class of the surrounding map unit.
	Slide or slip	A prominent landform scar or ridge caused by fairly recent mass movement or descent of earthy material resulting from failure of earth or rock under shear stress along one or several surfaces. Typically less than 5 acres.
	Sodic spot	An area where the surface layer has a sodium adsorption ratio that is at least 10 more than the surface layer of the named soils in the surrounding map unit, which have a sodium adsorption ratio of 5 or less. Typically less than 5 acres.
	Spoil area	A pile of earthy materials, either smoothed or uneven, resulting from human activity. Typically less than 5 acres.
	Stony spot	A spot where 0.01 to 0.10 percent of the surface cover is rock fragments that are greater than 10 inches in diameter in areas where the surrounding soil has no surface stones. Typically less than 5 acres.
	Very stony spot	A spot where 0.1 to 3.0 percent of the surface cover is rock fragments that are greater than 10 inches in diameter in areas where the surrounding soil has less than 0.01 percent of a surface cover of stones. Typically less than 5 acres.
	Wet spot	A somewhat poorly drained to very poorly drained area that is at least two drainage classes wetter than the named soils in the surrounding map unit. Typically less than 5 acres.